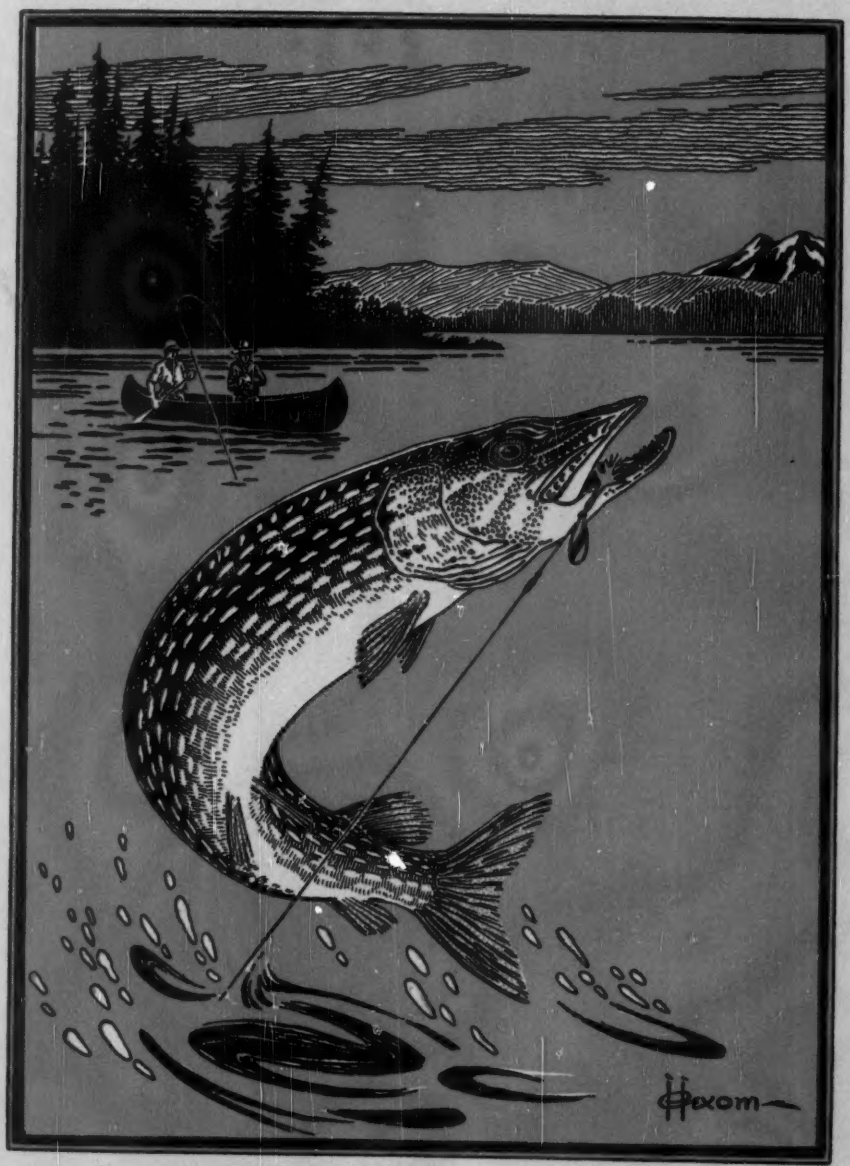
Nature Magazine



MAY
1958

VOLUME 51
NUMBER 5

50 Cents

STOP THIS FATAL RACE!

We said, "In God we trust," but we put our faith in H-bombs and missiles. Now we know that Russia too has H-bombs, missiles, and satellites.

We assumed that the way to peace is through superior military strength . . . to deter our "enemy" and back up our negotiators. The Russians have acted on the same assumption. So the frantic competition proceeds. The balance of fear swings between nation and nation. This is no climate for negotiation.

Every man knows in his heart and from experience that peace is not made by terror, nor security by might. Fear builds no homes, and panic plows no fields.

The race for military superiority is futile. The finish line is mutual extermination, and there is no other end

Let us stop this fatal race. Let us have faith in the strength of freedom and the power of righteousness. This new approach would involve enormous risks. But they are not as great as those involved in continuing to balance on the knife edge of terror. Recognizing man's capacity for evil, we must seek to reinforce his God-given capacity for good.

We could:

1 Cancel our nuclear weapons tests, because they are hurting men now and may warp the bodies of our grandchildren *and because our souls are betrayed when we use our minds to plan the destruction of God's creation.*

2 Start disarmament—by steps WE can take, because there will be no real peace without world disarmament, and no disarmament unless some nation starts *and because it is wrong to prepare to kill other men.*

3 Share our resources more fully, because helping people help themselves is a genuine answer to the appeal of Communism *and because it is wrong to keep so much when two-thirds of the world is sick and hungry.*

4 Consider the problems of men more important than the promotion of alliances, because a solution in Algeria is more important than NATO; settling refugees in the Middle East is more important than sending arms; *and because we are men and we know that men should live in peace and love one another.*

5 Strengthen the United Nations as an inclusive and responsible agency for peace, because nations in conflict need a common meeting ground *and because mankind is indivisible.*

6 Seek ways to bring men together across iron and bamboo curtains, because everyone would gain from commercial, scientific, cultural and religious contacts *and because the major foes of understanding are ignorance and bigotry.*

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Nature Magazine

MAY, 1958 VOL. 51 NO. 5

Published by the AMERICAN NATURE ASSOCIATION to stimulate public interest in every phase of nature and the out-of-doors, and devoted to the practical conservation of the great natural resources of America.

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Reviews

Conservation in America

By Dorothy Childs Hogner. Philadelphia. 1958. J. B. Lippincott Co. 240 pages. $3.75.

In the introduction to this book the author says that its grass roots lie in personal notes that she has made, combined with those of her artist husband. Reading the book one discovers that this is quite true. The result is a volume that approaches conservation differently from other books on the subject. The difference lies in a rather disorganized treatment, or so it seems at first. The first chapter includes notes about the beaver, the passenger pigeon, the great auk, the fight against the feather trade, the story of the bison and its last-minute rescue, the sea otter. The result of this approach makes for interesting and informative reading but not an orderly or complete picture of the assault on our wildlife resources. The rest of the book treats with conservation in similar fashion. The book is subtitled "The History and Preservation of Our Natural Resources," but it seems to us that this might be more accurate if the subtitle were preceded by something like the words "Highlights in. . ."

Geography in the 20th Century

Edited by Griffith Taylor. New York. 1957. Philosophical Library. 674 pages. $10.00.

This is a third edition of this volume, which draws upon a considerable list of distinguished geographical authorities in the United States, England, Czechoslovakia and Poland. Their writings are brought together in what constitutes a study of growth, fields, techniques, aims and trends of geography.

Gem Material Data Book

Compiled by Charles J. Parsons and Edward J. Soukup. P.O. Box 687, Mentone, California. 1958. Gems and Minerals. 36 pages. $2.00.

This is a compilation of information of special value to jewelers and gemologists, bringing together in tabular form a fund of data pertaining to gem materials. Both the authors are practical gemologists, and have made their compilations with an informed regard for the practical needs of people working in this field.

How to Understand Animal Talk

By Vinson Brown. Boston. 1958. Little, Brown and Co. 205 pages. Illustrated by William D. Berry. $2.75.

"Animal talk," says Vinson Brown," is almost entirely emotional talk of the kind we make when we grunt with pain or move our facial muscles into a frown or smile. It is largely talk about the present, without past or future. As an expression of emotions, on the other hand, it is usually far more complex and subtle than the rare emotional talk of men, and for this reason large parts of it often remain mysteries to us." It is to introduce the observer to some of these complexities, and to aid the listener to animal talk, that this western naturalist directs his book. He seems to have succeeded admirably, however much some of his readers may differ in their interpretation of animal language.

The Sun and Its Family

By Irving Adler. New York. 1958. John Day Company. 128 pages. Illustrated by Ruth Adler. $3.00.

In treating with the sun and the solar family, the author takes an interesting approach. He espouses the theory that the best introduction to his subject is by recreating the history of man's accumulation of knowledge of the sky. This proves most effective and should result in a greater comprehension on the part of the reader than is often derived from other texts.

Book of Indian Life Crafts

By Oscar E. Norbeck. New York. 1958. Association Press. 253 pages. Illustrated. $5.95.

The author of this practical book directs it to an audience of hobbyists, of whatever age, who find interesting and useful the varied crafts of the Red Man. The book should also be most valuable for youth leaders because it presents a variety of projects aimed at different youth levels. Besides the how-to-do text, there are excellent drawings that will aid in the application of Indian techniques.

Briefly Noted

The Ar.tic Tundra. By Delia Goetz. New York. 1958. William Morrow and Co. 64 pages. Illustrated by Louis Darling. $2.50. Weather, plant and animal life and the people of the top of the world, written for the younger reader.

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Nature IN PRINT

By HOWARD ZAHNISER

Birds, Extinct & Vanishing

THE MID-MARCH SABBATH ON which these comments are set down on paper is the beginning of both National Library Week and National Wildlife Conservation Week. The week contains within it the spring equinox—end of winter, beginning of spring—and it concludes with the convening of the Second Biennial Northwest Wilderness Conference in Seattle, Washington.

As to Library Week, I have just returned from a reception at the headquarters of our Prince Georges County (Maryland) Memorial Library and am about to formulate a commendation of a book or books. It was my pleasure to call the attention of the assembled group at the library reception to the fact that this is also National Wildlife Conservation Week, and the commendations I am about to express are of writings in behalf of wildlife conservation.

There is a compassion that motivates these writings and concerns that seems in keeping with the Sabbath, and the hopes for better wildlife conservation that they inspire seem in keeping with the sentiments of the vernal equinox and the expectations of a wilderness conference.

There could hardly be a better timeliness for thoughts about these writings—writings contained in a volume entitled *Extinct and Vanishing Birds of the World*, by James C. Greenway, Jr.

Man's disruption

This volume is evidence not only of man's disruption of the life community into which he has evolved or migrated, but also of his awareness of this disruption and his concern with it. It is a timely volume—not alone a record of extinction but mainly a description of the vanishing, a circumstantial warning, a diagnosis.

"We are *now witnessing*," writes Jean Delacour, president of the International Committee for Bird Preservation, in the opening paragraph of the book's foreword—"We are now witnessing the most tremendous changes in the world, and one of the saddest consequences is the awful threat to the existence of many forms of wildlife. Human populations increase; weapons are improved; new poisons are found and used; and remote areas, so far inaccessible, are penetrated more and more easily. As a result, plants and animals are fast decreasing. . ."

Almost at random I turn to one of James C. Greenway's specific accounts and read some of the particulars that sharpen Jean Delacour's general observations. Both in California and Florida, I read, the colonies of burrowing owls are smaller than they were fifty years ago, and Mr. Greenway points out that "the encroachment of civilization, the increase of cultivated land, the numbers of semiwild house cats, and shooting are responsible." In California, he adds, "the United States Government has for years poisoned and sealed ground-nesting mammal burrows; many burrowing owl broods have inadvertently been destroyed."

The California condor Mr. Greenway describes as "rare, local, and in great danger of extinction," and he goes on to explain—

Condors fewer

"No enemies of the California condor are recorded save man alone. The vast increase in human population and the increased range and efficiency of the rifle are the reasons (at least apparently) for the diminution in numbers of birds. During the same period great cattle ranches have been transformed into fruit farms, and it seems probable that the consequent reduction of available food has been a powerful contributing factor."

Again and again the particular accounts of the species that now seem to be vanishing are variations on the general theme of man's explosive dominance of the environment, or his inadvertent disruption of an ecology which he had not understood and to which he heedlessly did violence by introducing change that profoundly altered the established interrelationships. The book is thus a source book for data that show how human beings have gone wild in destroying the wildness of the earth and have become a malignancy in the life community of which they should be healthy members. As Paul L. Errington emphasized in his recent study *Of Men and Marshes*, "enlightened people just about everywhere" seem to accept, in its broader senses at least, the philosophy that man should work with and not against Nature, but Mr. Greenway's carefully documented case histories seem to demonstrate that the "avoidance of misconception as to the nature of Nature" and "the faculty for choice between wise and unwise alternatives," which this philosophy implies, have not yet been practically realized. The human agents of wildlife extinction have not yet become philosophers of cooperation with Nature, nor followers of this philosophy, and the growing hope that they and all of us may yet become citizens of human communities that, through law and duly adopted public policy, live in harmony with the land and its other inhabitants—this hope has not yet been fully realized.

Important volume

It is, however, tremendously important that there has been prepared and published such a volume as this one on *Extinct and Vanishing Birds of the World*. It is the third volume in a project established more than twenty years ago. Harold J. Coolidge, Jr., one of the faithful leaders of this project through the years, told of its beginnings in his forewords to the two earlier-published volumes. "In 1933 Dr. John C. Phillips, a founder and first chairman of the American Committee for International Wild Life Protection," wrote Harold Coolidge, "was an official observer for our Government at the meetings of the London Convention for the Protection of the Fauna and Flora of Africa. He returned from that conference. . .with the conviction that there was a basic need for the compilation of our present knowledge concerning the recently extinct and vanishing mammals, if we are to plan intelligently for the future preservation of wild life in this fast-changing world." In May, 1936, "largely due to Dr. Phillips's vision" a project for a comprehensive study was undertaken. In 1942 the first volume was published, a work by the late Glover M. Allen entitled *Extinct and Van-*

ishing Mammals of the Western Hemisphere with the Marine Species of All the Oceans. Three years later, in 1945, the Committee published Francis Harper's monumental work, *Vanishing Mammals of the Old World*. It is to these great compilations and appraisals that James C. Greenway, Jr., has added his work on birds of both hemispheres, *Extinct and Vanishing Birds of the World*. He has worthily completed a project that is significant not only as evidence of man's scientific interest to know, but also of his ecological conscience, his practical compassion, and his ambition to base on facts a program that can be effective in conserving species of life as one of man's valued natural resources and as part of his own desirable environment.

This volume includes not only accounts of the extinct and vanishing forms. Its "introduction and summation" will be of interest and value in understanding the terms used in such discussions and in seeing in summary the listings of extinct, probably extinct, and other groups. A "geography of extinction" summarizes the volume's information according to areas of the earth. Finally, the volume, which like its predecessors has been edited by Paul H. Oehser of the Smithsonian Institution, concludes (as they do, too) with a bibliography and index that Mr. Oehser has prepared.

Urge to action

This volume, like its predecessors, is not merely an encyclopedia of data and description. It is a motivation to intelligent action. It is an appropriate thing to be discussing this work at the beginning of a week that is National Wildlife Conservation Week and is to be concluded with the Northwest Wilderness Conference. Wildlife conservation must be a response from any student of this volume. Wilderness preservation is the specific answer to the question of how to preserve some of these otherwise vanishing species. Our hope for the condors, for example, is in the remote refuge that is within one of the areas of wilderness being preserved within the national forests. One of the great benefits of the Wilderness Bill now pending in Congress, and regarding which every reader of this page should write at once to his Senators and Congressman for support, will be its more certain provision for the safe-guarding of some areas of remote habitat where wild creatures can escape the influences to which James Greenway's accounts again and again allude. To his work and those of his colleagues in science and conservation we owe what Harold Coolidge in his 1945 foreword called "a sound foundation for future plans."

The first volume in this series, Glover M. Allen's work on mammals of the Western Hemisphere, had on the verso of its title page a quotation from Henry David Thoreau's *The Maine Woods:*

"Every creature is better alive than dead, men and moose and pine-trees, and he who understands it aright will rather preserve its life than destroy it."

Francis Harper's volume of Old World mammals on its title page verso quoted from Theodore Roosevelt's *African Game Trails:*

"There are no words that can tell the hidden spirit of the wilderness, that can reveal its mystery, its melancholy, and its charm. . ."

The comparable quotation in this new volume is Capitaine Richard Whitbourne's expression of wonder and humility:

"As if God had made the innocency of so poor a creature to become such an admirable instrument for the sustention of man."

In this humble marvelling, in Thoreau's understanding of the value of all life, in Theodore Roosevelt's perception of the value to man of areas of wilderness where the wild life is still wild, a reader can find spiritual inspiration for a conscientious study of these volumes in which we face the facts of extinction and diminution and realize, if we face them candidly, our own responsibility.

In remembrance of Wildlife Conservation Week and National Library Week it could be an excellent volume to add to your nearest public library.

Extinct and Vanishing Birds of the World. By James C. Greenway, Jr. New York: American Committee for Wild Life Protection (New York Zoological Park, New York 60, N. Y.). 1958. X + 518 pp. (5¾ by 9¼ in.), with foreword by Jean Delacour, frontispiece in color from a painting by D. M. Henry, 88 text drawings of birds by D. M. Henry and 1 by A. Seidel, 8 maps and 2 charts in the text, bibliography, appendix listing museums in which extinct birds are to be found, and index. $5.

Wildlife stories for young readers

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Reviews

Flowers and Plants for Interior Decoration

By Esther Wheeler and Anabel Combs Lasker. New York. 1958. Hearthside Press. 190 pages. Illustrated. $7.95.

Combining interesting and practical textual suggestions, accented by splendid pictures in color and black and white, this book should be welcomed by interior decorators, both amateur and professional. An introductory chapter discusses flowers for every home and their basic functional and decorative uses. A second chapter deals with harmonizing flowers and containers with various period styles that may be employed in interior decoration. Other chapters discuss effective use of color and texture, designing flowers for room settings; plant crafts and techniques, with a wealth of craft suggestions; use of pot plants; table adornment, and flowers for special occasions. A good index adds to the value of this most useful and interesting volume.

The Story of Life

By H. E. L. Mellersh. New York. 1958. G. P. Putnam's Sons. 263 pages. Illustrated. $3.95.

First published in Great Britain, since the author is British, this is the first American edition of this interesting book. The author tells the story of evolution from a modern viewpoint, writing popularly.

Seaweeds at Ebb Tide

By Muriel Lewin Guberlet. Seattle 5, Washington. 1956. University of Washington Press. 182 pages. Illustrated by Elizabeth L. Curtis. $3.50.

Rather tardily this excellent book by one who has been an occasional contributor to our pages comes to our attention. A member of the English Department faculty at the University of Washington, Mrs. Guberlet has spent summers studying the plant and animal life at the Oceanography Laboratories at Friday Harbor, Washington, where her husband was professor. In this book, beautifully illustrated by Elizabeth Curtis, the author presents popular descriptions of many Pacific Coast seaweeds. The eighty-seven full-page drawings make this a handbook for the identification of these plants that are found between the limits of high and low tides. Certainly it will make a seashore visit more meaningful and rewarding.

Russell J. Rutter

AMONG OUR MAY AUTHORS

John F. Warth

John F. Warth, one-time ranger-naturalist in the National Park Service, lives in Seattle, Washington, where he is active in conservation work as a member of "Mountaineers, Inc.," and as a charter member of the North Cascades Conservation Council. He produces magazine and newspaper articles about his favorite mountains, the Cascade Range, and spends weekends and vacations in search of remote lakes, valleys and peaks not listed in the guide books. . .Paul S. Bulla, free-lance writer and former newspaperman of Washington, D.C., makes a specialty of articles about animals whose lives are directed by instinctive reactions that sometimes seem to border on the supernatural. . .Sacramento, California is the home of C. M. Goethe, who, with his wife, initiated the Nature study programs at the resorts around Lake Tahoe in the California Sierras that were the starting point for our present National Park Service interpretive program. . .Ivan R. Tomkins, who has many times in the past contributed to the pages of Nature Magazine, is a naturalist who lives at Savannah, Georgia . . .Harold D. Babcock, retired for a number of years from the staff of the Mt. Wilson and Palomar Observatories in California, is now a volunteer observer in charge of the Hale solar laboratory at Mt. Wilson. . .Canadian naturalist Russell J. Rutter, of Huntsville, Ontario, works with the correspondence branch of the Ontario Department of Education in teaching Nature to school children of the lower grades, and is an enthusiastic member of the Ontario Bird Banders' Association. . .Romeo Mansueti is chief fish biologist at the Chesapeake Biological Laboratory at Solomons, Maryland. . .Robert G. Snyder lives in the Adirondacks of New York about which he writes, where, with his wife, he indulges himself in "the observation of . . .wildlife and all things of Nature."

River in the Sea

By Hans Leip. New York. 1958. G. P. Putnam's Sons. 223 pages Illustrated. $3.75.

The subject of this book is, of course, the Gulf Stream, that great river of warm water that flows in the Atlantic. The relation of this stream to early exploration occasioned many stories, some of them fantastic, about this sea river. In this book the author interestingly deals with early knowledge and present knowledge of the Gulf Stream, with its importance to climate and with the sea life it sustains. He has written a most interesting and informative book, which is fortunate in a good index and bibliography.

The Experimental Control of Plant Growth

By Frits W. Went. New York. 1957. The Ronald Press. 343 pages and plates. $8.50.

This book is mainly the story of large-scale cooperative effort in the plant sciences, with special reference to the work carried on at the Earhart Plant Research Laboratory of the California Institute of Technology. The principal author is Professor Went of Caltech, and there are contributions by W. C. Ashby, L. T. Evans, A. W. Glaston, H. Hellmers and William M. Hiesey. It is, of course of particular interest to plant scientists and an important contribution to literature in that area.

America's Garden Book

By James and Louise Bush-Brown. New York. 1958. Charles Scribner's Sons. 752 pages. Illustrated. $7.95.

Originally published in 1939, this standard book on all phases of gardening in America has been revised and supplied with new illustrations. In this new edition emphasis is placed on the small property and the informal garden for outdoor family living. Horticultural practices are not static, nor are kinds of plants, so this revised text brings things up to date. This is a "must" for the library of any gardener.

Briefly Noted

System Engineering. By Harry H. Goode and Robert E. Machol. New York. 1957. McGraw-Hill Book Company. 551 pages. $10.00.

This book shows how a number of important fields such as statistics, computers, game theory, information theory, servomechanics and control are put together to attack large-scale problems in engineering, such as the development of radar systems, telephone systems, or guided missile systems.

The Factual Origin of Our Earth and the Whole Cosmos. By Teodor Horochowsky. New York. 1958. Greenwich Book Publishers. 79 pages. $2.75.

A new explanation of the origin of the earth and its physical phenomena.

Contents noted BY THE EDITOR

BILLBOARD CONTROL AS FEDERAL POLICY was affirmed as a part of a highway construction bill passed by Congress just before it recessed for the Easter period. The act is not a strong one, but it does affirm the need for control of the environment of the system of Interstate Highways in the interests of safe and pleasurable travel. The law specifies a 660-foot setback from the edges of the right-of-way on each side of the highways. It allows signs not exceeding 500 square inches and advertising services to be obtained off the highway within twelve miles of the location of such signs. This could invite a rash of small signs. An incentive of one-half of one percent of construction costs is offered to the States entering into agreement with the Secretary of Commerce by enacting legislation in conformity with the Federal standards.

Credit for achieving this legislation encompasses a long list. In the Senate there were Senators Gore, Neuberger and Kuchel as leaders; in the House Congressmen Fallon, Blatnik, Clifford, Davis and Hale, and forward-looking colleagues in both houses. Private organizations comprise a long list, including the American Automobile Association, Garden Club of America, National Council of State Garden Clubs, American Institute of Architects, many State Roadside Councils, national conservation organizations, American Association of Nurserymen and many others. The American Nature Association, which has fought for billboard control for thirty years, provided headquarters for the National Roadside Committee, volunteer personnel for its work and contributed to its "war chest." This committee of individuals served as an information clearing house, distributed more than 100,000 educational folders and other information. The newspapers, with editorials, cartoons and feature articles, made a great contribution. There is enough credit to go around, and includes the army of individuals who expressed themselves to their Senators and Congressmen on this issue.

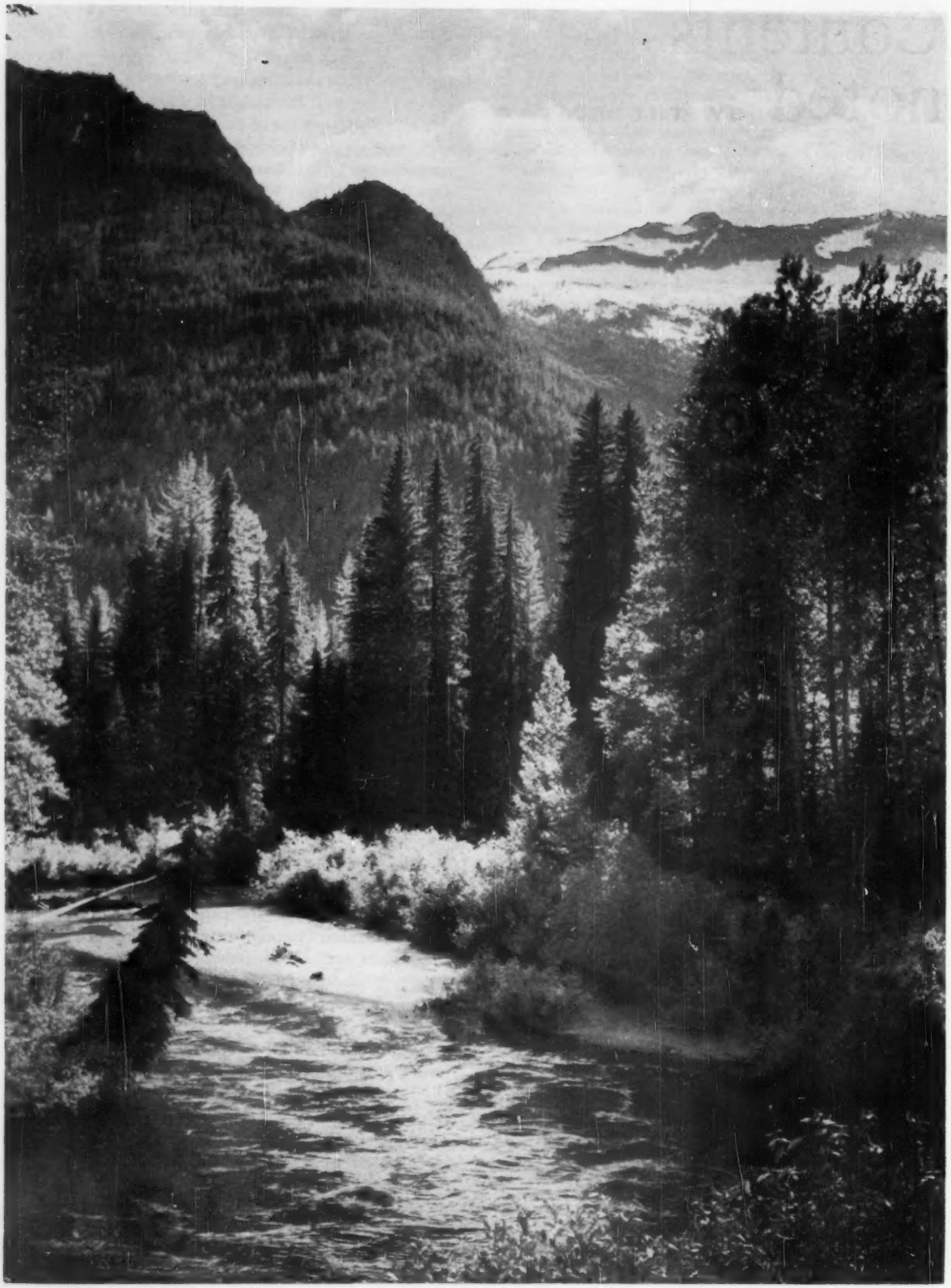
This is the first hurdle. Now action by the States must be taken, country-wide, if this fine and expensive system of highways is to be protected.

VISITORS TO OUR NATIONAL PARKS and other areas under the jurisdiction of the National Park Service during 1957 established a new record in numbers. The 59,300,000 visitors in 1957 represented an eight percent increase over the figure for 1956, and totals some four million more visitors than were anticipated in projecting probable figures in connection with the Service's "Mission 66" program. Looking at these statistics, Director Conrad L. Wirth sees in them a challenge, as well as the probability that the expected visitation of eighty million by 1966 may well be reached by 1964. One interesting phase of the visitor use of the parks is found in the sharp increase in the use of campground facilities. Camper use jumped from 3,633,000 camper days in 1956 to 4,189,000 days in 1957. This, Mr. Wirth feels, "reflects the appreciation of our people for their national parks and their understanding of the great dividends the parks can pay in renewed physical and spiritual strength."

WHILE IN A STATISTICAL MOOD it is pertinent to record, as we do annually on this page, that sales of hunting and fishing licenses continued the upward trend during 1957. Highlighting the pressure on these fish and game resources, is the fact that a record total of 34,195,183 licenses were sold during 1957, an increase of 1,031,352 over the previous high of 1956. Of these 14,918,416 hunting licenses were sold, an increase of 456,568. Anglers and hunters paid a total of $90,617,039 for licenses, permits, tags and stamps (not including the Federal "duck stamp"). Michigan, with 1,250,004 licenses for hunting, New York, with 1,024,975, and Pennsylvania, with 938,275 were the leading States in the number of registered gunners. When we read such figures, and consider them in the light of expanding human population, consequent contracting wildlife habitat and gunning pressure, concern about the future of our wildlife populations is inevitable. When one attends the sessions of the North American Wildlife Conference, as we did in early March, one realizes that wildlife management specialists are doing their utmost to maintain a balance, but the question always arises as to whether they can really maintain a safe lead.

MAINTAINING WETLAND HABITAT for our migratory waterfowl is part and parcel of the whole wildlife problem as related to populations and gunning pressures. Drainage of wetlands continues in many areas, most of it to supply food-producing acreage in a country already over-produced. The only answer to this trend lies in the acquisition and preservation of nesting, resting and feeding areas for our migratory waterfowl. One attempt to reverse this drainage trend is represented by legislation that would earmark 65 percent of the income from the sale of the annual "duck stamp" for wetland acquisition. This might help, but Daniel H. Janzen, Director of the U. S. Bureau of Sport Fisheries and Wildlife, would go farther. He proposed, at a Senate hearing on the bill, that the duck stamp be increased to three dollars and that, except for the cost of printing and selling it, *all* revenue derived from it be devoted to buying wetland habitat. This makes sound sense, and it is difficult to see how a duck hunter could object to an additional dollar under such a policy.

R.W.W.



Beyond Chiwawa Ridge, in the foreground, and north of Stevens Pass in the Cascades of Washington State is the verdant Napeequa Valley.

The two-mile descent sinto the Napeequa Valley was a continuous garden of flowers, grasses, ferns, and flowering shrubs.

How one man found his Shangri-la in a

Green Valley of the Cascades

By JOHN F. WARTH

Photographs by the Author

WHO HAS NOT dreamed of finding somewhere a hidden valley cut off from approach on all sides by rugged mountains or impassible canyons? Such a vale must not be barren and inhospitable to the weary explorer, but must present a picture of green productiveness—a place where one might almost expect to find the surviving remnant of a lost race; or where modern pioneers, weary of the uncertainties of an atomic age, conceivably could retreat into the simplicity and closeness of Nature.

After reading *Lost Horizon*, I reasoned that surely amid the complex of the North Cascades of Washington State—America's least explored mountain area—must lie a Garden of Eden as beautiful as any existing in fact or legend in remote lands, and I made up my mind to find it.

Poring over topographic maps, I spent many a winter evening looking for my ideal valley, and the few that seemed promising were explored on summer trips. But always it seemed that something was lacking. Either the view was lost in a jungle of brush or trees, or the enclosing peaks were not placed right for a perfect composition.

Several years ago, I set out to examine another candidate for my Shangri-la, this one in the proposed Glacier Peak Wilderness Area, north of Stevens Pass. It was impossible to get much advance information on what lay ahead. I could not find a ranger or Forest Service employee who had ever set foot in this lofty mountain-

The bright Napeequa meandered along a green valley floor, and the late afternoon sun cast streamers of mellow light through gaps between icy summits.

guarded valley. Several had climbed part way up the discouragingly high Chiwawa Ridge, almost a mile above the road, but only one had ever reached the top to glimpse from afar the strangely beautiful valley of the Napeequa River.

Starting up the trail from Maple Creek Camp, I was none too certain of the success of my adventure. Could I get across the vast mid-July snow slopes that could be seen thousands of feet above? Straight up the mountainside headed the trail—if it could be known by such a complimentary name. The heat and dust made the climb pure misery, loaded down as I was with a heavy pack. But the sun was sinking rapidly behind the high ridge, and soon it was pleasant going.

As usual in a mountain ascent, there was the fascination of observing the change of forest types with change in elevation. Gradually, as I wended my way upward, Douglas fir yielded to Pacific silver fir. These eventually gave way to timberline alpine fir, mountain hemlock and white-bark pine. Tough and flexible yew, ordinarily an understory tree, clung tenaciously to the moist rock slopes over which the avalanches roar in season. These could be spotted in the distance as dense thickets of a pleasing brownish-green hue.

Once above the dense forests, the going became rougher. Sometimes it called for skills more common to the mountaineer than to the occasional climber. At one point, the trail faded out on a long outcropping of jagged rock. Up this one had to scramble as best he could. Finally, the dreaded snowfields were reached, and to my relief, they were not as steep as they had appeared from the bottom. The chief difficulty was in keeping to the trail. After losing it several times while crossing snow patches, I noticed that the tracks of a lone deer always led unerringly to the trail on the other side. Even switchbacks hidden beneath the snow had failed to confuse this "dumb" animal.

Finally, after what seemed like an almost endless climb, nothing remained but a steep grassy slope, topped by a dangerous-looking snow cornice. Just as I was beginning to despair, a hidden passageway appeared between a rock wall and the sheer snowdrift, otherwise negotiable only by a properly equipped alpinist. A few more steps, and victory was mine at last!

"This is the place." The famous words of Brigham Young upon discovering the Salt Lake Valley came to my mind as I gazed westward. Far below lay a vale of enchantment. A giant glacial trough opened a long vista reaching to the crest of the Cascades. The bright Napeequa meandered along a valley floor of purest green. Here and there, the verdant expanse was broken by snowy remnants of the many spring avalanches that roar down the steep walls. Glacier Peak, 10,528 feet high in the far distance, climaxed a sea of peaks (all but two unnamed) more than eight thousand feet above sea level. Adding to the other-worldliness of the scene, the late afternoon sun cast streamers of mellow light through gaps between the icy summits.

The descent into the valley was accomplished with reverent steps, as if approaching a sacred city. The entire two miles was one continuous garden of flowers, grasses, ferns, and flowering shrubs. Dainty red and white heathers, paintbrush, and aster fleabane flourished in the rocky soils near timberline. As the narrow trail wound its way down through the cliffs, yellow stonecrop, pink lewisia and dozens of other species dear to rock garden enthusiasts made it hard to keep an eye on the precarious footing. Whenever the trail dipped into a side gully, red and yellow monkey-flower, white bog orchid, and lavender butterfly-tongue played a color symphony accompanied by the tinkle of splashing water. An occasional brush patch reminded me that these were indeed the North Cascades. But even here there was delicate beauty; the rose-like petals of salmonberry and thimbleberry, the white rhododendron, and tall creamy plumes of goatsbeard. Farther down, as the slopes began to level off, thick accumulations of volcanic soil—blown out of Glacier Peak only a few centuries ago—supported the tall grasses and ferns that characterize the Glacier Peak country. And peeking out from be-

tween the blades and fronds were the corollas of asters, valerians, and mertensias. Patches of fireweed here and there added their gay notes to the prevailing greens. Through all this verdure one waded knee deep and waist deep. From the pass to the valley floor there were a total of at least seventy genera of flowering plants, not counting the ferns and grasses. Many of these were represented by several species. Truly this was amazing variety, especially for such a high altitude!

By the time I reached the bottom, it was almost dark. Camp had to be set up hurriedly, and there was little time to notice the curious deer that approached to within twenty feet for a view of the strange creature, man. In fact, I scarcely realized that not a mosquito appeared to remind me of the planet Earth. That night, as I lay cozily in my bag, the moon slipped silently over the nearby ridge. Here I was, all alone, and yet so enthralled in the magic of that moonlit world-within-a-world that it never occurred to me that I probably should be feeling lonely.

The next day was spent exploring the details of the valley. The reason why the trail had to go over the high Chiwawa Ridge rather than merely following the Napeequa upstream from its junction with the White River soon was evident. For the comparatively broad and level valley narrows into a virtually impassible canyon, with Yosemite-like walls of granite towering on either side. The river drops for about seven miles over a series of rapids and falls. How high some of these falls may be is not known. There seems to be no record of anyone having traversed the entire length of this rugged canyon.

After hurrying across a lofty plateau, the waters of Louis Creek plunge into the valley down a stairway some two thousand feet high.

Exploring upstream, I saw, up a short side valley, a spectacular mass of dazzling ice, which I identified as the unnamed glacier on 8576-foot Mount Clark. Several more sizeable glaciers lingered on unnamed peaks farther west. But for one who had just crossed several dozen mid-July snowdrifts, it was hardly a surprise to find so much ice in the region. Avalanches had poured such quantities of snow into the stream beds that the torrents had had to tunnel underneath. Except for one of these dangerous snow bridges over a swollen creek, I never would have arrived in the upper valley.

It was thrilling to see wildlife thriving in so inaccessible a spot. A sandpiper followed closely, uttering loud *pee-weet's* in a gallant attempt to chase the intruder from its home territory. A hawk circled over the seemingly lifeless uplands of rock and ice west of Mount Clark. A dipper made numerous food-gathering excursions between the river and a nearby waterfall. Never did she fly more than a few feet above the stream. Her full-grown baby waited patiently on a spray-splashed rock; although still too young to fend for itself, it was already performing the amusing deep-knee bends that gave a name to this bird of mountain streams.

Mammals observed were deer, hoary marmot, and a kind of mouse. Signs of bear and coyote were found, and animal trails were common on the steep slopes high above the valley. Apparently the valley was too "civilized" for mountain goats, for not until a later trip to the summit of Mount Clark was I able to locate the home of this inhabitant of the crags and cliffs.

Everywhere in the valley, waterfalls tumbled down the cliffs, some more mist than water. But all were insignificant compared with the great Louis Creek Falls. After hurrying across a lofty plateau, the stream plunges joyously over a stairway some two thousand feet high.

I can tell you all about the "goings on" of this fabulous stream even though only the lower flight of the giant stairway is visible from the valley floor. You see, I later returned with a friend, and together we scaled the valley walls to discover—perhaps for the first time—a lost world in the sky. But this would be a story in itself—of steep slopes that would have been considered cliffs had they not been covered with such lush herbage; of mist-drenched hanging gardens; of thick deposits of pumice that looked as if they had blown in only yesterday; of sparse, picturesque forests of alpine larch; of diminutive bells of white heather thriving on the rocks at the very edge of the precipice, with glacier after glacier forming a magnificent backdrop across the valley of the Napeequa.

The view up a side-valley revealed the spectacular mass of ice that is the unnamed glacier on 8576-foot Mt. Clark. In the valleys, avalanches had poured great quantities of ice and snow into the stream beds, so that the torrents had to tunnel underneath the barriers, creating dangerous snow bridges.

But let me leave something for future explorers to discover for themselves, for the very mystery of such places is an integral part of the explorer's experience. It is something that can only be passed on from generation to generation if we are willing to carry on the fight to preserve them "unimproved"—remnants of the wilderness like my "Shangri-la" in the wild "back country" of the Cascades.

Ferns

By HAYDN S. PEARSON

Ferns are contemporary living links with time-shadowed ancient eras. Millions of years ago, when large areas of this nation were steaming jungles, fern trees grew 100 feet high. Together with tall horsetails and stubby club mosses, they were the fantastic, dominant motifs of that ancient landscape. The spore process of reproduction is probably one of the pivotal steps in the ages-long evolution of hard-cased seeds. They evolved from humble marine plants when Earth was young, and they have about finished their role in a great and exciting drama. There are some 6000 species of ferns on our planet, a small fraction, undoubtedly, of the number in ancient times.

There is something deeply appealing about a fern glen. A glen is a narrow, cool ravine where hardwoods and evergreens shade the banks. Graceful ferns paint green pictures among trees and rocks. Often a spring-fed brook sings down the ravine, tumbling over rock ledges and rippling around colored stones. Ground cedar and ground pine trail over faded brown leaves; in spring, trilliums, ladyslippers and violets are patches of color in golden sun shafts that come slanting through the branches.

In August, the ferns make a beautiful picture. Tall clumps of interrupted ferns lean over the brook; dark-green, toothed wood ferns hide gray-black decaying limbs; leather wood ferns cluster around protruding rocks, and narrow beech ferns grow lushly in the shadows of large boulders. Polypods creep along the fissures of ledges; and near the upper edge where the sun strikes for several hours, the green-gold, delicate hay-scented ferns paint a feathery picture in the bright light. Ferns are among Earth's humble plants, but as one studies their graceful symmetry, he is looking at a green chain that links the present with the time when Earth was young.

The Babbitt's home in Petersham, Massachusetts, is a veteran of 218 New England winters. In 1927, the Babbitts moved in, and have been remodeling it ever since.

The Babbitts of Gay Farm

By ALDEN S. WOOD

Photographs by the Author

The temperature stood adamantly at zero as I swung the Ford into the string-straight, dirt driveway that led up the hill to the rambling, gambrel-roofed farmhouse on the outskirts of rural Petersham, Massachusetts.

Slinging the camera over my shoulder and grabbing my faithful notebook, I slid from the seat and stumped across the frozen drive towards the door, my breath streaming behind me like a jet's vapor trail. Before I could knock, a pleasant, blue-eyed woman swung the door wide and welcomed me with "Come in before you freeze to death; coffee's on!" Behind her, a tall, craggy-faced man with a shock of graying hair nodded "hello," and motioned me towards the kitchen.

This was my introduction to the Babbitts of Gay Farm, a young-at-heart, middle-aged couple whose work as naturalists specializing in herpetology has won them national notice, if not the complete devotion of less scientifically inclined neighbors!

Both Lewis Hall Babbitt, 55, and his wife Corinne, 51, have been avid naturalists since childhood. Lewis, a Hartford native who studied zoology at Trinity College, caught his first garter snake more than half a century ago, while Corinne, graduated from her native Minnesota's fine university in 1931, cannot remember when she has not been fascinated by the natural world.

The couple met during a visit in Petersham in 1927, and were married in 1933. They moved into their present home then, and, as Corinne quips, ". . .have been remodeling ever since!" Small wonder—their grand old homestead was erected in 1740, two hundred and eighteen years ago! Obviously built to last, the rugged dwelling actually needs only insulation and exterior touching-up, plus whatever interior alterations the

Lewis and Corinne Babbitt discuss the contrast between a six foot black rat snake from New England, at the left, and a honey-colored yellow rat snake collected in the Lake Okeechobee Section of central Florida.

Babbitts might choose to make.

One would expect such an historic home to be really "lived in," and nothing could be closer to the truth. In addition to people, it is lived in by an iguana lizard, bullfrogs, skinks, turtles, a rattlesnake, tadpoles, a boa constrictor, and even an alligator.

Two of these "boarders" require more than a modicum of care in handling: they are "Spottswood," the five-foot eastern timber rattlesnake, and "Dr. Mann, the Green Dragon," a three-and-a-half foot, apple-green and white iguana lizard from Central America. (He is so named because he was a gift from a friend, Dr. William C. Mann, Director emeritus of the Smithsonian Institution's National Zoological Park in Washington, D. C.).

These and other reptilian and amphibian bed-fellows earlier won for the Babbitts a reputation for eccentricity, if not worse, among the local inhabitants. Those neighbors who did come to call usually arrived late and left early, rarely to pay a second visit. Being by nature easy-going folks, and scientists to boot, the Babbitts were not too upset by this countrified attitude, although it is hard to imagine that they enjoyed their semi-ostracism. They continued their studies, their collecting, and their field trips, and let the comments fall where they might. Today, happily, Petersham *and* Massachusetts point with proverbial pride to these two naturalists, who remain the same unassuming people they always have been.

"Dr. Mann" is a green and white iguana from Central America who flourishes on a diet of fruit and vegetables. The expression of concern on Mr. Babbitt's face is probably being caused by Dr. Mann's needle-sharp claws as he climbs up for a piece of lettuce being offered by Mrs. Babbitt.

What brought about this change in public opinion? What made people realize that the Babbitts were not "snake charmers" or eccentrics, but citizens capable of making a unique and valuable gift both to adult and juvenile society?

Probably the biggest factors were hard work by the scientists and the natural curiosity of people. Back in 1933, when the Babbitts were married, they decided the way to devote the most time to Nature and herpetology was to go into them as a business. For Lewis to hold down a bread-and-beans office job would take too much time and energy away from their science. Thus they decided to do two things: the first, to collect specimens for zoos and other markets; the second, to begin planning lecture tours with reptiles as the principals.

They started gathering specimens in earnest. They traveled through the South, as far west as Texas and Mexico, and even visited Cuba. In time, they also built up a striking library of color slides, not only of reptiles, but of flowers, trees, birds, and mammals as well. They made arrangements with the Smithsonian Institution to bring requested specimens to its famed zoo; specimens such as boa constrictors, turtles, lizards, and the uncommon jubu (pronounced hoo'boo) snake from Cuba. The Babbitts discovered that this snake, which is hooded like the cobra, is mildly poisonous, a fact not previously known to them.

Over the next decade, the couple worked long, hard months at perfecting their various lectures—collating slides with spoken comments, and boiling down reams of notes into brief, punchy presentations. During depression years, the demand for herpetological lecturers was hardly spectacular, but the man and wife team managed to get by.

In 1935, they had their "closest calls." Oddly enough, both Corinne and Lewis ran into trouble in the same year, and at the same spot, a large rock slide located in Connecticut.

Lewis had cornered a full-grown blacksnake in a rock pocket, but as he thrust his gloved hand into the aperture, he felt something hit the little finger of his left hand.

"I felt a sudden, hot sting. . .like a wasp's," recalls Babbitt.

As he jerked his hand back, he glimpsed the shape of a deadly copperhead thrashing away under the stones. Forgetting the blacksnake, he quickly clambered down to where Corinne and a Hartford biology teacher were collecting nearby. The teacher grabbed his snake-bite kit and administered an anti-venom shot; then they rushed Lewis, whose hand already was beginning to swell, to a hospital. He spent two days there getting a series of shots, and recovered with no further ill effects.

On a later trip, Corinne had two frightening experiences on this same rock slide. One afternoon she was bitten by a startled black rat snake. All such non-poisonous snakes have six rows of teeth, four upper and two lower. Corinne discovered that most of this reptile's small teeth remained imbedded in the ugly wound on the knuckles of her right hand. She daubed on

iodine, and suffered more than a little discomfort as the teeth worked their way out during the next week.

The second episode was similar to Lewis' brush with disaster. She and her husband were climbing towards an unexplored part of the slide, he ahead and to her right. Lewis happened to glance down just as Corinne was reaching up to get a handhold on a small outcrop. His sudden shout froze her hand in mid-air. . .and a moment later, into Lewis' collecting bag went a writhing copperhead. Corinne's hand would have landed squarely upon it had she reached over the flat ledge!

"Such incidents," declares Mrs. Babbitt, "along with occasional gashes from 'Dr. Mann's' curved claws, all are a part of the game."

By the mid-forties, the Babbitt lectures were well established, and gaining popularity. And on their own initiative, the unselfish naturalists had started an informal series of Nature walks with Petersham children.

Gradually, the word got around that these two people were not "odd" at all; in fact, when it came to Nature, they were pretty smart! So it was that in 1947, the town of Petersham invited the Babbitts to become an official part of the town's Summer Playground activity. This included a budget and the requirement of making an annual report. Then, they had sixty pupils. Today, the number is 130! And in a town with only some 913 inhabitants, that is a respectable percentage indeed.

Underlying all the lectures and the Nature studies is a philosophical concept founded upon Albert Schweitzer's "reverence for life" theme. The Babbitts teach their young folk that it is not as important to love a certain animal as it is to respect and understand it, especially in relation to the living natural community as well as the human. They are strong believers in teaching awareness of natural objects. Adults who have joined Babbitt Nature walks have expressed honest amazement at how little they had actually seen on previous jaunts through the woods.

From early spring until late winter, Lewis and Corinne lead hectic but happy lives. They lecture regularly at Camp Hazen (the Connecticut Y.M.C.A. camp in Chester, Connecticut) and Camp Woodstock (the county "Y" camp at Woodstock, Connecticut); they squeeze in an occasional weekend of collecting in order to fulfill commitments to various zoos or other scientific activities in the market for specimens.

A typical week has gone like this: Monday, an all-day show at Wellesley Junior High School auditorium with color slides, movies, and a lecture on collecting live specimens in Florida. The afternoon session is devoted to individual discussions, with permission granted to touch and study at close range many harmless reptiles and amphibians. The Babbitts point to Spottswood, coiled aloofly in his double-walled cage, and teach the students precisely what he is and why they must never approach him in the wild without being prepared.

Tuesday, a half-day show in the Petersham Elementary School where the program is modified to be educational for a six to twelve-year-old audience.

Wednesday, up to the Springfield, Vermont, Senior High School for an all-day session on general New England wildlife. To this more mature audience, points concerning environment, habits, and ecology are brought out in detail.

Thursday, a special showing at the Worcester, Massachusetts, State Teachers College. Emphasis is on how teachers can impart awareness in Nature to their students; the scientific and humane way to handle certain small, wild creatures.

Friday, away to the Rotary Club in Franklin, New Hampshire, to talk with parents about places where children may study Nature and, more important, how parents can instill Nature interest in young folks.

Saturday is devoted to household chores, remodeling, perhaps cutting wood against the next winter, and cage building. Gay Farm is built right next door to Nature—out spotting animals one evening, Lewis counted eighty-five porcupines contentedly decimating a nearby field of red clover!

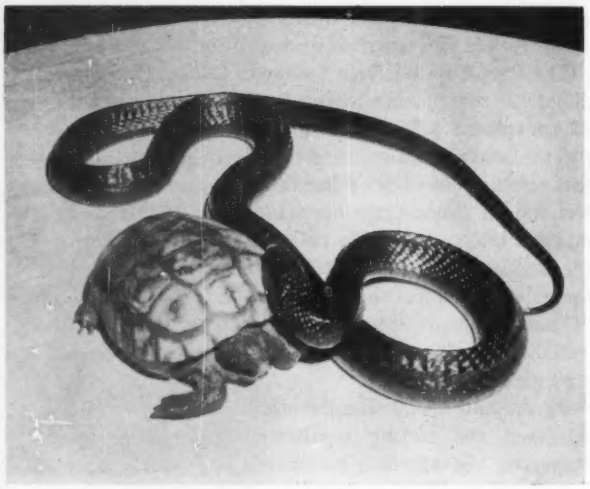
With a bit of prompting from Dad, little Kristin A. Bagley strokes the smooth back of an Australian skink held by Corinne Babbitt. Awaiting his turn with obvious interest is young Mark C. Bagley.

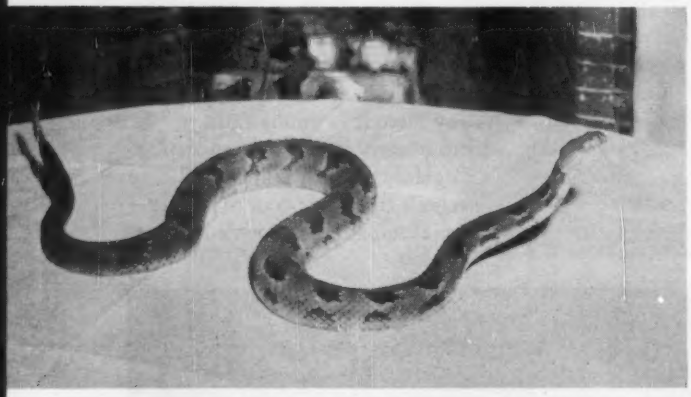
Part of the winter months finds the Babbitts climbing into their new station wagon loaded with camping gear, cages, and collecting material. Their 1957 tour took them through Mississippi, Tennessee, and Virginia, with a stopover at Washington for a visit to the zoo. Along

the Mississippi levees, they collected a queen water snake, rat snakes, ring necks, racers, chicken snakes, and diamond water snakes.

While many specimens are shipped out via railway or air express, some must be carried considerable distances in the wagon. Poisonous species are placed in a jar, then in a can lined with Spanish moss, and finally in a bag. Why? Consider the possible consequences of even a *minor* automobile accident! Once, while traveling to a show at the Jamaica Plain Childrens' Museum, the Babbitt's car was struck broadside by another vehicle. No one was injured, but a police car came by to investigate. Lewis and Corinne went to the cruiser for the routine questions, while a young officer casually inspected their auto.

Suddenly he sprang back and roared, "Hey, lady,





↑ Two natives of Florida that are staying at Gay Farm are a gopher tortoise, collected in 1955, and a sleek Florida indigo snake, gift to the Babbitts from a grateful student.

← Spottswood, the eastern timber rattlesnake, "sits" for his portrait in the big dining room at Gay Farm. Spottswood was not allowed to enter a full coil while he was being photographed.

did you know that there's a snake loose in your car?"

"Well, I'm not really surprised," answered Corinne, matter-of-factly, and walked over to pick up a dazed black snake like a coil of hose and pop him back into his cage. Actually, the collision had jarred open several cages. Corinne still chuckles as she recalls the young officer's solemn invocation of the Deity, spoken as her small hands efficiently re-caged several fierce-looking reptiles. (Spottswood, always carried in a double cage, had not escaped, but was a rather rattled rattler.)

Petersham's Babbitts today enjoy an ever-growing popularity. Their contribution to the Summer Playground was such that many parents approached them asking for a similar program for adults. Further esteem was shown when some of the youth groups started growing too large for safe supervision, and busy mothers volunteered to come along as aides.

Children's Nature walk groups are broken up into three age categories: three-and-a-half to six; seven to nine; and ten to 14. Lewis and Corinne agree that the younger are by far the most enthusiastic. To little folks, virtually *everything* in Nature is excitingly new and absorbing. Perhaps you wonder just what a three-and-a-half year old toddler can learn. The Babbitts report they are remarkable at identifying trees, flowers, and certain rocks. Too, their uncluttered young senses quickly catalog many woods sounds and scents.

The training program begins with general Nature study, and advances logically with emphasis on reptiles and amphibians. Work in the field is important, say the Babbitts, but they insist also that a fully-rounded student must have his share of book study and, if possible, a college degree or two.

Conservation is stressed, as is forest fire prevention. Lewis does not believe there is a child in Petersham more than three years old who cannot point out the Prospect Hill fire tower and tell what it is and why. Field trips to the Harvard Forest and Museum, Quabbin Reservoir, and Carter Pond Fish Hatchery aid the children in seeing conservation methods in actual practice. As you can see, where the Babbitts do not consider themselves expert, they seek out those who are.

One other important aspect of conservation study is the explanation of who collects specimens for research use, and why this is done. For example, the frog is a commonly used laboratory specimen because its anatomy closely resembles that of the human. Since the Babbitts do considerable collecting, they know all the details of when and how to collect. Frogs, although always in demand, are never touched during the egg-laying season. On a large enough scale, (*continued on page 276*)

Odyssey of the Pacific

By PAUL BULLA

A CHILLING wind from the Polar ice cap sweeps southward over Arctic Alaska and Bering Sea, heralding the approach of winter, and a general exodus of the avian population of that vast region is under way. From the broad mud-flats and low, rolling tundra of the Alaskan coast, the Pacific golden plover is leaving its summer breeding and nesting grounds for the long over-water migration to its winter home, in the Hawaiian archipelago and the islands farther to the south.

PHOTOGRAPH BY THE AUTHOR

With the approach of winter, the Pacific golden plover leaves its nesting grounds on the Alaskan coast and heads south across two thousand miles of open sea. Photograph shows the Pacific golden plover, *Pluvialis dominica fulva*, in its breeding dress.

Skimming along the shoreline, wading in the shallows, they busily search for food. A restless urgency appears to govern their every movement as they skitter about, or wheel into the air for brief, circling flights. These excursions become more frequent as the restlessness increases. At last the moment arrives, and they take to the air, heading south on one of the most remarkable flights made by any land or shore bird. On clearing the Aleutians, all landmarks are left behind, and it remains an unsolved mystery as to how they are enabled to reach their destination across a trackless sea.

Lying more than 2000 miles west of Lower California, more than 2000 miles south of the Aleutians, and 3700 miles east of Japan, the Hawaiian Islands are farther removed from continental territories than any other areas of the earth's surface. But this round trip trans-oceanic flight between the coast of Alaska and their winter quarters is made year after year by the winged adventurers.

While many are known to pause for food and rest on Nunivak, the Pribilof, or Aleutian Islands before attempting the long overseas flight south, large numbers are believed to fly from the nesting sites to their Pacific goal with no intermediate stop-overs. But for the hardier of these migrants, the Hawaiian Islands are merely way stations on an itinerary that includes Palmyra Island, more than a thousand miles to the south, and other island groups, deep in the south and southwest Pacific.

Although the plover can alight on water and again take wing, it does so infrequently, for it is a true wader. As the birds do not have the webbed feet of swimming birds, they can remain afloat but a short time. Some writers are convinced that they must alight for food and rest during their oversea flights. But Dr. Herbert Friedman, curator of the Division of Birds at the Smithsonian Institution, says that he knows of no authentic proof upon which to base such a conclusion.

The Pacific golden plover, *Pluvialis dominica fulva*, is an Asiatic subspecies of the eastern or American golden plover, *P. dominica dominica*, but is smaller and more brightly colored than its American cousin, the average length being about nine and one-half inches. The breeding and nesting grounds of the Pacific form are in western Alaska, from Cape Prince of Wales south along the coast of Norton Sound, in Bering Sea, to Nunivak and Nelson Islands. The American form ranges from Point Barrow eastward to Baffin Island, but the winter homes of both species are separated by thousands of miles of land and water. In the fall, the Pacific form flies south and west over the Pacific to its winter haven; the American form heads east to Labrador and Nova Scotia, and thence south to southern Argentina.

The flight speed of members of the plover family has

been clocked from airplanes at from forty to fifty miles per hour. Ornithologists generally agree that the former speed is not excessive, and well within the birds' power for sustained flight over long distances. Being of the flapper type on the wing, as distinguished from gliding or soaring birds, plover fly with slow, effortless strokes that conserve their strength and speed them to their goal.

The adult birds start migrating early in August, leaving the fledglings of the year to join them some weeks later, when their strength is equal to the flight. Although the early arrivals in the islands still retain their breeding dress, they begin to discard it almost at once. Their plumage, at this time, consists of a dark brown mantle mottled with white, and golden edgings to the feathers covering the back and upper surface of the wings. The breast and lower parts are black, divided from the upper parts by a distinctive white band curving from the bill over the forehead and eyes, and down the sides of the neck to the breast.

The transformation into winter garb almost completely changes their appearance. The upper parts are gray with yellowish markings, but lacking the brilliance of the breeding dress. The black plumage of the underparts has disappeared with the molt, and has become a grayish white. The throat and breast are a buff-tinted gray, while the conspicuous white band of the breeding garb has almost entirely disappeared. The bill is black, with a slight swelling on the upper side near the end. The stilt-like legs are a permanent green. As the male and female plumage has the same coloring and markings in winter and summer, it is almost impossible for the casual observer to identify sex, although the female is slightly larger.

During their eight or nine months' sojourn in the islands, Pacific golden plover range from the coastal clearings to the plains of the high central plateaus, in a region 7000 to 9000 feet above sea level. The preferred forage areas are the newly cultivated cane and pineapple fields, and upland pastures. As they feed almost entirely on destructive insects, including army worms, cutworms and caterpillars, they are welcome visitors on the plantations. Moving between the upland meadows and the shorelines, where mollusks, larvae and small fish are plentiful, they fatten and thrive on a varied and abundant fare.

The *kolea*, as they are known in the Hawaiian Islands, have lost much of the shyness of their nesting days, and fearlessly invade city parks or village gardens in their forays for food. However, the writer found close observation almost impossible, as their long wading legs carried the birds rapidly to a safe distance whenever they were approached. They are frequently to be seen on the lawn of the Administration Building in downtown Honolulu, and at Hickam Field nearby. These appearances in inhabited areas of the Islands are believed to be due largely to the protection afforded them for many years. This was not always so, as this migrant was considered a table delicacy, and was mercilessly hunted before the protective law put a stop to the wholesale slaughter.

Early in March, the molt into summer dress is under way. As the time draws near for the flight to the north, small flocks of the birds may be seen along the marshy areas of the coast, and there is a tendency for them to spend more time in short, experimental flights offshore. By late April, or early May, they have acquired their black-breasted plumage, and the nesting urge has become too strong for further resistance or delay. The period of indecision is over. In the late afternoon, or just before dark, a widely-circling flock, in rising flight, swings northward behind its leader, and disappears in the dusk. By mid-May, all but a few stragglers have left for their homeland. The few remaining appear to be those that have not completed the molt into breeding dress, or are too sickly to attempt the flight.

By the time they have reached the mainland, mating has usually occurred, so no time is lost in choosing housekeeping sites. These are invariably located at some distance from those of their kind. Since courtship and domestic life is limited to about three months, the nests are of the simplest construction. In shallow depressions scratched in the reindeer moss or lichen of the tundra, and lined with leaves, grass or other scraps of vegetation, the female lays four eggs. In color they are a green-tinted gray, smudged with dark sepia or light brown blotches, irregular in shape and size.

During the incubation period of twenty-seven days, both parents take turns sitting on the eggs. Should an intruder appear in the vicinity, the nesting parent, uttering its shrill alarm whistle, attempts to lure the trespasser away from the nest. At such times, the cries are in direct contrast to the mellow notes uttered in flight, or during uninterrupted feeding intervals. As their cries range from loud but musical whistles to harsh notes, when disturbed, descriptions of the song vary widely.

To some extent, food is obtained from the shallows along the shoreline, but during the nesting period the Pacific golden plover subsists chiefly on blueberries and crowberries uncovered by the spring thaw. These are found in abundance on the Alaskan plains.

The newly hatched chicks stagger into the world on wobbly legs, needlessly long for the weight they must support. At this time they are small balls of down, with greenish backs and black-mottled wings. From the beginning they are self-supporting, and as they grow rapidly, are able to leave the ground for short distances

within two weeks. By that time they have acquired their juvenile plumage, which is a checkered gray and yellow above, and buffy gray below. By the end of the first month, they are wholly independent of their parents.

The speed with which the young birds acquire flight feathers, along with the ability to use them, are developments that come none too soon. By mid-July, the nesting season is over, and the parent birds are gathering in flocks along the seacoast for the flight south. As the short Alaskan summer draws to a close, each morning finds fewer adults foraging along the shores of Bering Sea. The day dawns when all the parent birds have vanished, and their offspring are left to Nature's guidance in a vast region swept by chilling Arctic winds. By late October, the stronger and more daring youngsters have started the flight south; by mid-November, all have left for a rendezvous with their elders.

Many theories have been advanced in attempts to explain how adult plovers are guided to and from their winter retreats. None of these can apply to birds only a few months old that span the monotony of sky and water for the first time, and unerringly reach their island goals. But each fall aerial caravans of immature plovers leave the only home they have ever known, and, unaccompanied by adult guides, find their way to a destination of which they have no previous knowledge.

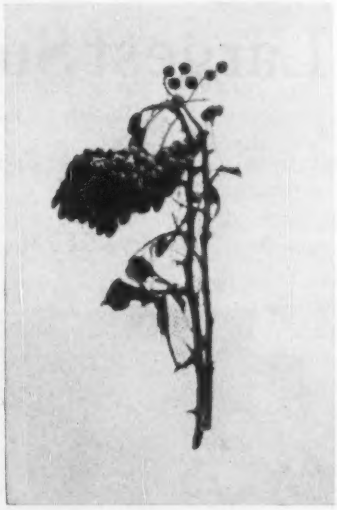
While it is generally agreed that the motive for the fall migration of the plover is to avoid starvation, that motive does not exist in the sea-girt islands of the central and south Pacific, where food is plentiful throughout the year. The only explanation governing the return flight appears to be the urge to reproduce in the region of their birth. While both of these factors are tied to survival, this tyranny of habit does not explain the migration of the plover.

An Insect Work of Art

By
BEULAH WOODS ALLEN

I HAD BEEN acquainted with bagworms most of my life, and their fairy-like cradles intrigued me. I thought of them as wolves, of a sort, in sheep's clothing.

In my winter walks about the yard, I made it a practice to search for them on the cedars and on the pines. A spindle-shaped white silk bag taken from a cedar looks quite different from one taken from a pine. For it is the habit of the bagworm, the larva of a lepidopterous insect, *Thyridopteryx ephemeraeformis*, to incorporate in the silk covering bits of leaves, twigs, or bark taken from the host plant. I had seen them so often in this disguise that I pictured them in no other way.



Inside the bundle of orange berries was a bagworm dressed for the ball.

Photograph by Curtis Allen

Imagine my surprise, then, to have a familiar bagworm appear in such an unfamiliar place as a pyracanthus bush! And all decked out like a Cinderella dressed for the ball, in a bag trimmed with showy orange pyracanthus berries.

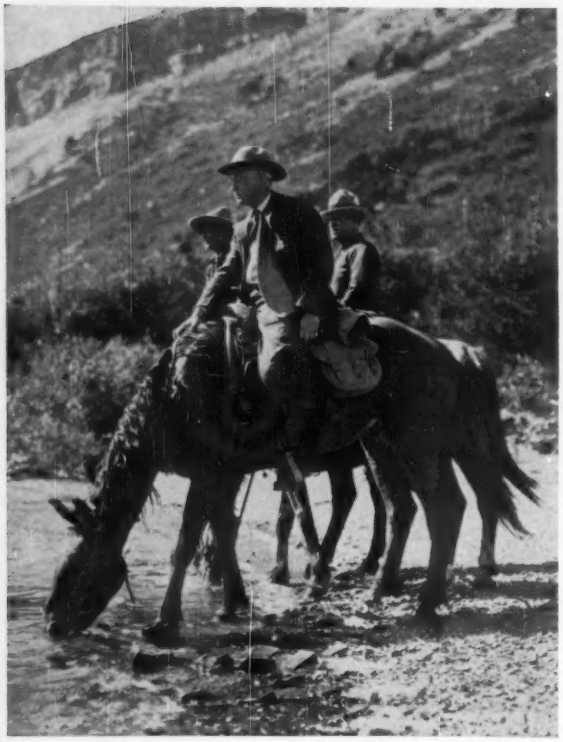
Like the monarch butterfly's chrysalis of delicate green and gold, this bag was a rare and beautiful work of art, to be found only in Nature's museum. It gave the effect of a lovely beaded purse, and was pretty enough to frame.

We can only guess at the reason for these decorative bags. Since they are effective in making the bagworms less conspicuous, they are, perhaps, a form of camouflage. However, they are functional as egg depositories.

Bagworms have the usual lepidopter's life cycle—the eggs, the caterpillars, the moths. The black, furry male moths are winged. In early autumn, they desert their bags to mate with the wingless grub-like females. Mating takes place in the female's bag. Then the male dies.

After the female deposits several hundred eggs, she spins out enough silk to fasten shut the top of her bag. Then she, too, dies, leaving her cocoon to her young, to be used as a cradle.

The young hatch in late spring. The tiny caterpillars crawl from the bag, feed on the leaves, and each young bagworm begins spinning a new bag for itself, making it larger as it grows. Encased in the bag, with only their heads exposed, they crawl about on the tree or shrub, eating the tender foliage.



NATIONAL PARK SERVICE PHOTOGRAPH

Stephen T. Mather (in the foreground) spent a night at a resort on Lake Tahoe in the California Sierras, and heard the Nature program there. The interpretive program of our National Park Service may be dated from the coincidence of Mather's visit and that program.

With good reason C. M. Goethe and the late Mrs. Goethe of Sacramento, California, have often been called "the father and mother of the National Park Service's Interpretive Program." On several trips to Europe the Goethes saw and took part in Nature field excursions in Germany and elsewhere. As a result they brought back techniques that inspired them to adapt this activity to the American scene, first at Lake Tahoe and, later and at the urging of Stephen T. Mather, first Director of the National Park Service, to Yosemite. We recently asked Mr. Goethe to write a bit of the history of this program, which he has been kind enough to do in this article.
Editor.

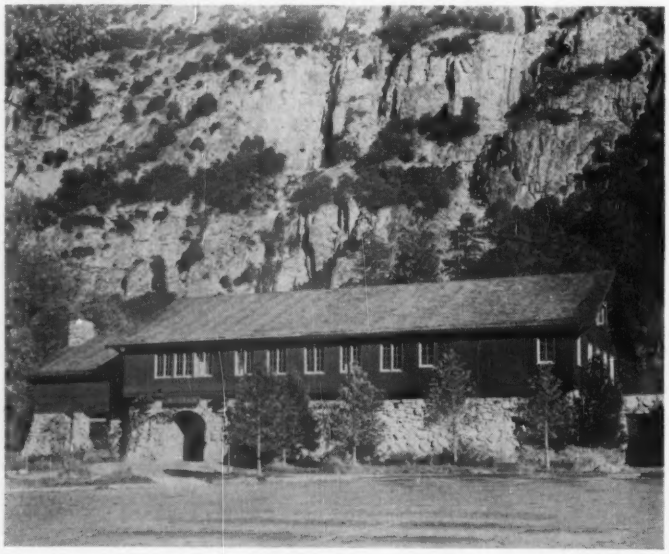
The World's Largest Summer Camp

HERE IS A salute to Mickey Kelly! Why? Grandad, who was a college professor, used to comment, "One does not know how much his students learn. He does know he himself daily gains wisdom from them."

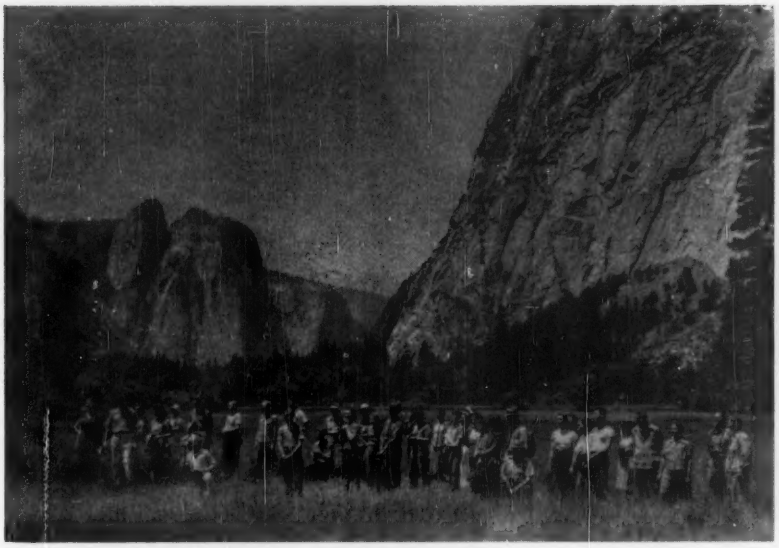
Mickey was an example of not only Grandad's observation but of how Nature guiding in the National Parks came to be. Mickey's origin was a broken home in New England. From there he set out on a cross-country hitch-hike toward a California where, he had heard, he could pick oranges from the tree. On the Nevada desert en route, he had flagged a train to get a life-saving drink. The writer begged his custody from the sheriff after this evidence of Mickey's "juvenile delinquency." He was taken to our home for observation. There, he could pick oranges from our garden tree. The final decision was to route him to Sacramento Orphanage Farm, of which Grandmother, in Gold Rush Days, was a founder.

Mickey was an Ishmaelite. He fought everybody from the matron to the smallest kid. They fought back.

NATIONAL PARK SERVICE PHOTOGRAPH



The Nature interpretation activities that had been started at several Lake Tahoe resorts by the Goethes were transferred to Yosemite. The Park Museum is pictured as it appeared in 1938.



A group in a Yosemite meadow hears a ranger-naturalist interpret the features of the park.

COURTESY YOSEMITE NATURAL HISTORY ASS'N

Even I could not find that minimum of good I had insisted was in every boy.

Once, with a circle of some twenty lads, I was squatted on the ground under the fig tree. The Nature yarn that day was Philippine bumble-bees. Mickey always had refused to join the story-telling circle. Bumblebees, however, awoke something in Mickey. He stood at a distance, ears alert. I happened to mention that I never could find a California bumblebee's nest. That electrified Mickey. "I'll show you one right now!" How he did so takes too long to tell here. Mickey, however, became an excellent assistant naturalist.

By C. M. GOETHE

Then the day came when he said: "Mr. Goethe, I'm almost the age I'll have to leave the Orphanage Farm. As long as I can boss the kids, I'm O.K. When I'm out in the world again, I'm gone. Please get me into the Navy—and on one of those newfangled submarines."

Mickey saw World War I. He had risen as high as possible without an Annapolis education. He volunteered to lead a raid, which, they told him in advance, meant the supreme sacrifice. The last letter he wrote said: "Want you to know I do this because of Orphanage Farm bumblebees. I am a good citizen."

So, again, here is a salute to Mickey Kelly, junior naturalist, hero on a perilous mission and good citizen. A salute, because he was, perhaps, foremost in a notebook of Orphanage Farm cases that prepared me to know what I had accidentally discovered on Switzerland's Lake-of-the-Four Forest Cantons! It was on a steamer there I met a young teacher with a score of enthusiastic youngsters. I climbed Rigi Kulm with them. After the descent, I vowed I would carry to the United States the idea of *Wandervoegling*—the Nature study field excursion.

That teacher introduced me to the leader of the Swiss movement, who advised a series of trips to Europe. This he proposed in order to understand clearly the varied national techniques of taking children, under biologist leadership, to study Nature. It was really the Agassiz theory of "not books, but living things."

Repeated visits to Europe, following the Swiss leaders' advice, yielded ever-accumulating facts. In Norway, where patronage by Nature-conscious Britons loomed considerably, summer resorts found it profitable to staff Nature guides. Geology lessons were everywhere in the fjord-slashed coast. In the central snow-fields was an alpine flora adjusted to an environment almost as severe as parts of Greenland. In Britain, itself, field trip participation sometimes had a flavor of prizes for good school work. In fact, in parts of Scotland the outings

COURTESY YOSEMITE NATURAL HISTORY ASS'N

In the early nineteen-twenties, a school for ranger-naturalists was established at Yosemite National Park to train leaders in the objectives of interpretation.

were called "School Treats."

In Holland, the grower from whom we bought narcissi for our home garden commented that Dutch bulbs then led the world because producers had schoolboy backgrounds from these Nature study field trips. This was voiced, too, in the testimony of fruiterers from whom we purchased hothouse grapes and hothouse peaches. It was evident that intelligent thinking about Holland's commercial profits was based on earlier youthful studies of such things; for example, as insect control by birds. On one canal boat trip, (so slow one could often get off and walk), a teacher and her wooden-shoed pupils, out on a Nature study field excursion, welcomed this American.

All these examples, however, were colored by education under monarchial governments.

STEPHEN TYNG MATHER
JULY 4 1867
JAN. 22 1930
HE LAID THE FOUNDATION OF THE NATIONAL PARK
SERVICE, DEFINING AND ESTABLISHING THE POLICIES
UNDER WHICH ITS AREAS SHALL BE DEVELOPED AND
CONSERVED UNIMPAIRED FOR FUTURE GENERATIONS.
THERE WILL NEVER COME AN END TO THE GOOD THAT
HE HAS DONE.

GEORGE A. GRANT, NATIONAL PARK SERVICE

This is a close-up photograph of the Stephen T. Mather Memorial plaque at Madison Junction in Yellowstone National Park, unveiled on Mather's birthday, July 4, 1932.

Some adjustment was required to fit the concept into our American democracy. Then, too, our native California was only recently emerging from the abnormality of gold rush days. Most folks still were dominated by a pioneering philosophy that, of necessity, had little time for "long-haired professors." That was why Mrs. Goethe and I selected Lake Tahoe for our "Laboratory." Six resorts ringed the lake. At one, Fallen Leaf, the owner was a longtime friend, the late W. W. Price, who had majored in biology at Stanford. It was jokingly alleged he had a chipmunk, a rattlesnake, and a mosquito named for him. He immediately saw the possibilities of what Mrs. Goethe and I were attempting, inspired by our experiences overseas. He converted reluctant owners of the other five resorts to the idea of extending hospitality to the two naturalists who conducted the Tahoe Nature walks. So these naturalists covered the six resorts, one a day, each week.

Popular imagination was electrified. Confirmed anglers abandoned trout fishing for Nature study. One father came to my tent one morning at daybreak: "Here are a half-dozen different twigs. I hardly know a cabbage from a pinecone. My sons think me all-wise. I don't want to wreck their dreams—at least, not now. Please help me identify what they brought in yesterday." I did, and I also joined in some of the daytime Nature walks, and the evening addresses at campfires, or indoors. This was principally to try to add a bit of geographical glamor, from our having joined the European *wandervoegling*. The question-box after such talks strengthened the conviction derived from my after-banking-hours character-building work with problem boys. I came to appreciate the professor-sagacity of Grandad. I constantly learned more from my listeners, and became increasingly convinced, among other things, that perhaps half of juvenile delinquency was due to inheritance. I felt, however, that perhaps the other half *was* environmental, as with Mickey Kelly, who had a bright mind.

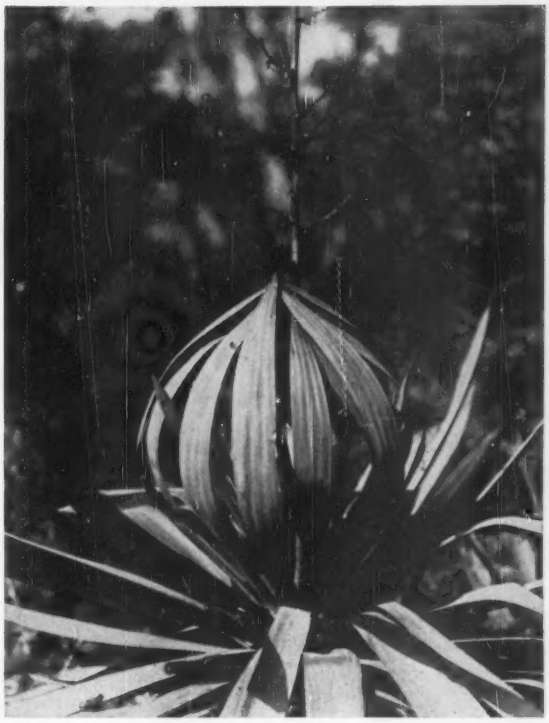
However, the half-dozen spaced trips to Europe were followed by the "Tahoe Laboratory," to create which Mrs. Goethe and I banked enough to cover expense of the summer "laboratory test." We then told the University of California we would cover expenses of two scientists they would recommend. This brought Dr. Harold Bryant and Dr. Loye Miller into our experiment.

Then, one day, came a tired man—Stephen Mather. He had sold his Death Valley holdings to London. He had offered my friend, Woodrow Wilson, who had become President, his borax profits to "pump-prime" a National Park chain. This $5,000,000, he hoped, would stimulate Congress to budget, over some years, the $50,000,000 he envisioned as the cost of a National Parks System. He afterward told me he felt he had been beaten in Congress; this, despite the fact he had defeated plottings to convert Yosemite into a vast gambling casino, like present-day Reno or Las Vegas. He said he knew their interests were powerful enough to gain revenge by blocking his pet Congressional National Parks appropriation. He feared that his dream was ended. Feeling too exhausted to go to Sacramento for his Pullman, he returned over the Tioga to think things out. This meant overnight somewhere. Twilight brought him to Fallen Leaf. Going to (*continued on page 274*)

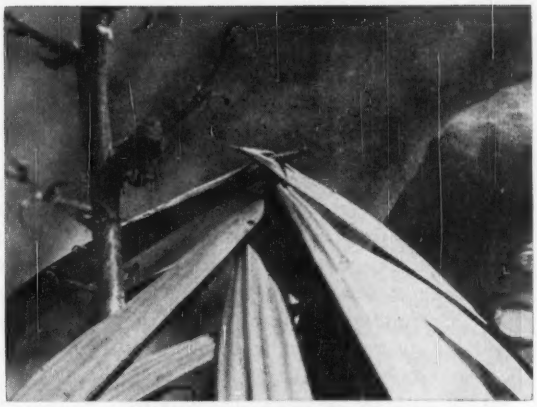
Living Baskets

By IVAN R. TOMKINS

Photographs by the Author



The inception of a "yucca basket" probably is accidental, and may start when a strong wind blows two young leaves together.



A close-up photograph shows the detail of the top of a *Yucca gloriosa* basket.

THERE ARE few plants native to our southeastern States that can bring themselves to the attention of the unwary as suddenly and painfully as the members of the genus *Yucca*, more commonly known as the "Spanish bayonet," from the stiff leaves terminated by needle-sharp spines. Thickets of Spanish bayonet make formidable fortresses for birds and small mammals on the lookout for shelter, but the flowers are large and showy, making the plant an attractive one for the flower garden or the driveway.

For a long time I had been puzzled by the curious basket of leaves, often dome-like, pinned together by terminal spikes, that crowned some of the yucca plants growing on the coastal dunes of the Southeast. It was tempting to guess that the "baskets" were the work of mischievous hands. Since, however, they were found often on isolated islands to which the idly curious hardly would be attracted, this theory seemed a trifle weak. An old fisherman first pointed out one of the baskets to me, and he, too, wondered how it came about. I showed the baskets to a number of people, including a botanist, without receiving a satisfactory explanation. Since my situation made it impossible for me to keep a continuous watch on one of the plants, I hoped someone else would be able to make observations, and perhaps discover the secret of these natural basketmakers.

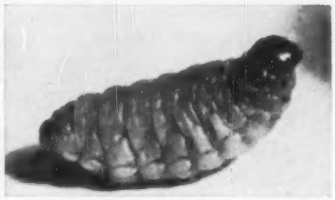
Finally, one of my friends located a plant that was convenient to watch, was able to report on it, and the secret came out. This basket-forming yucca is the species known as *gloriosa*, with leaves that are stiff and deeply concave, almost boat-shaped, at the outer ends. If the spine of a growing leaf catches in the hollow of an earlier leaf (which of course is lower down on the stem) it must, in order to grow to full size, bend outward in the middle. In turn, this leaf blocks the tip of the next succeeding leaf, which pierces *that* one, and must bend even more to attain its full size. A succession of such leaves eventually forms a basket. Sometimes one of the outer leaves tears free, and bends outward normally.

The inception of a yucca basket is probably accidental. Perhaps it may start first when a strong wind blows two young leaves together. The other members of the family, not having such deeply concave tips, seem not to behave in this manner. It is likely that their leaves, not being as stiff, soon bend outwards, are seldom caught together, and offer no chance for such a basket to get started.

These are the seeds of the Mexican plant of the spurge family that are commonly known as "jumping beans." There are two smaller flat sides and a larger third side that is convex.

Strange Case of the Jumping Beans

By HAROLD D. BABCOCK



This is the insect responsible for the "jump" in jumping beans—the larva of a species of moth.

PHOTOGRAPHS BY LILO HESS

THE POPULAR term "jumping bean" is, of course, a misnomer. So-called jumping beans are seeds of a Mexican plant belonging to the spurge family; but, for the sake of brevity, let us continue to refer to them as "beans." And although the following incidents happened more than twenty-five years ago, their memory remains vivid, because of the puzzling questions they raised.

This is a story of six Mexican beans, all similar, and each having two sides roughly flat, and a third that was convex. The beans were, at most, probably less than one-third of an inch long, and less than one-quarter of an inch thick.

All six beans showed normal behavior. If left undisturbed a short time, they began to make small spontaneous movements, accompanied by clicking sounds. It is well known that such movements and sounds result from the convulsive activity of a larval insect within the shell of the bean, the larva having developed from an egg laid by a species of moth in the flower of *Sebastiana pavoniana*.

One evening, after watching their aimless movements on a table, I placed the beans together on a horizontal wooden mantle shelf, eight inches wide and about six feet long. On the following morning, the beans had disappeared, but at length were discovered in a close huddle beneath a clock that stood at the center of the mantle, some thirty inches from the place where they had been left the evening before.

The following evening, the beans were placed thirty inches from the clock, but on the opposite side. During the night, they repeated their performance. Similar observations were made each night for a week, after which the beans became inactive.

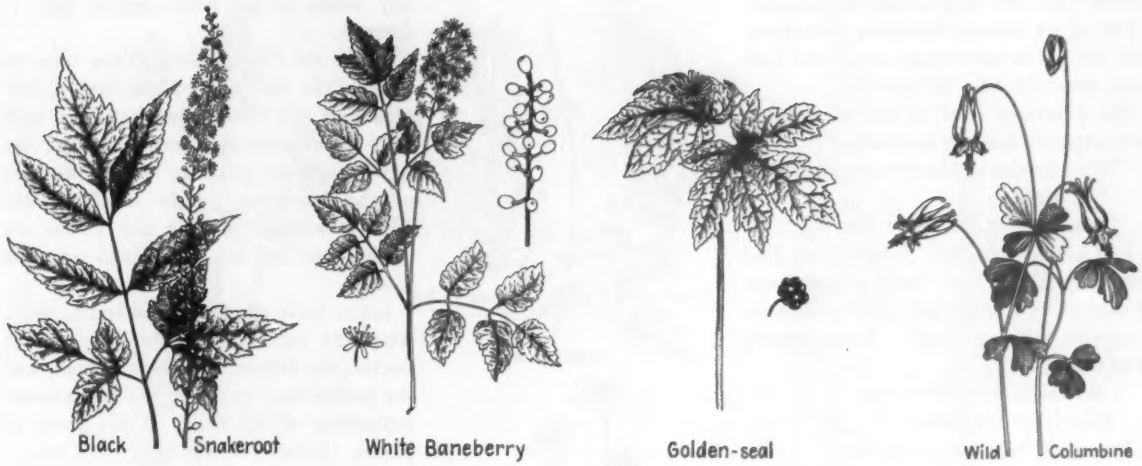
After placing the beans at the starting position, the first visible movements, so far as I can recall, were directed towards the clock. Each bean moved with its own velocity. An hour after starting, some had advanced twice as far as others.

The spring-driven pendulum clock had a wooden case that was supported at the four corners on brass pads, each a quarter of an inch thick. This small clearance between the base of the clock case and the shelf was sufficient to permit some freedom of movement. To enter this space, it was necessary to pass between two adjacent corner pads a little more than three inches apart. As seen from a point on the starting line, the rendezvous of the beans thus had a horizontal extent of only about six degrees of arc. Although the wall at the back of the shelf provided a possible constraint, the front of the shelf was open. No beans strayed to this edge and fell off.

Sounds made by the clock obviously were being transmitted clearly and strongly throughout the wooden shelf, and the frequencies of the sound waves were probably in the range of from 100 to 100,000 cycles per second. The low figure was estimated by listening to the clock, and the rough upper limit was obtained from the velocity of sound in steel, and the size of the pallet in the escapement of the clock.

The interesting questions arise as to why the sounds were attractive, how the insects perceived the direction from which the sounds were coming, how they steered their courses, and whether there were preferred frequencies that might have resonated in the shells of the beans, perhaps more stimulating than others.

It seems likely that the specimens used in the tests were typical, and that similar behavior might be expected under comparable conditions. Perhaps some reader of *Nature Magazine* might be interested in proceeding on from here!



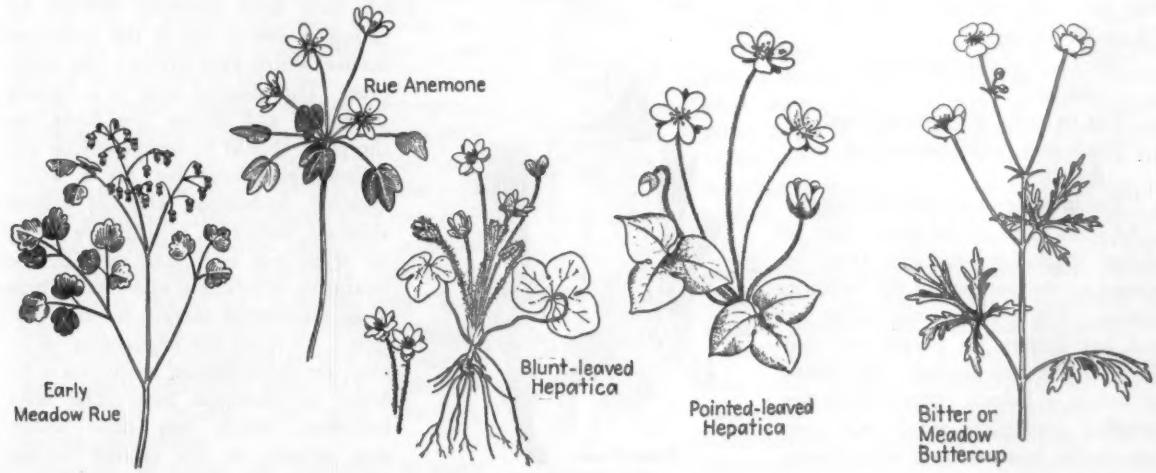
The Buttercup Family

By E. LAURENCE PALMER

This is the ninety-sixth of NATURE MAGAZINE'S *special Educational Inserts*

IT HAS long been the practice of youngsters, when roaming through fields and pastures, to hold a buttercup under the chin of a companion and claim that he must like butter because he can see the yellow reflection of the brilliant flower on the child's chin. Indeed, I think that this was one of my earliest and most persistent superstitions. Since it did not make too much sense it may have been a good thing for me because it made me question other superstitions. Certainly, there is no basis in fact in this myth. Neither do we find in Nature anything much more brilliantly yellow than the hue of a buttercup. Is it any wonder that poets have found in the buttercup flower an inspiration for verse?

As is so frequently the case, poets generalize too frequently and too freely about buttercups. To them, a buttercup is just a buttercup, while botanists recognize as members of the family some three hundred species in twenty genera as native of the United States, and some thirty-five genera and 1500 species in the world. Under these circumstances, it might be easier to go along with the poets and talk about buttercups than to try to keep up with the botanists. We shall try to go our own way here and favor neither the one nor the other. Let us dispose of the poets first. They give us an impressionistic



picture that we might like to analyze.

One of my favorite buttercup quotations tells us: "The buttercups across the field made sunshine rifts of splendor."

The dilettante spirit of the poets again finds expression when another says;

"When daisies and buttercups gladdened my sight
Like treasures of silver and gold."

In Gilbert's *H.M.S. Pinafore*, we find buttercups used to try build up some sort of concept, although just what it may be I am sure I do not know. Anyway most of us have heard;

"I am called little Buttercup
Dear little Buttercup
Though I could never tell why."

At least Gilbert did not commit himself to any kind of personification and obviously played safe. We can, therefore, offer no criticism here.

To my mind, one of the most appropriate uses of buttercups by poets comes in the well-known "A Day in June" where we read;

"The cowslip startles in meadows green
The buttercup catches the sun in its chalice. . ."

In Clara Smith's "Jack in the Pulpit" a number of members of the buttercup family are paraded before us, usually in a highly imaginative manner:

"And the columbines gravely as sentinels stand
On the lookout with all their red trumpets at hand. . . ."
"Meek-faced anemones drooping and sad. . ."
"Buttercup's faces beaming and bright. ."

Mary D'Alton O'Connor, who I have quoted frequently and who died within the past few months, gave us in her "Lest We Forget":

"The Gold of the buttercup's chalice"
"The twisting of clematis vines"
"The honey guides marked on flowers"
"The braving of snow by hepaticas"

At least three of the more than 500 things in Nature that she loved belonged to the members of the buttercup family. Those of us who knew her and her interest in poetry can only deeply regret her passing. Her ability to reduce a Nature concept to a few essential descriptive words was truly remarkable in these days when loquacity seems to get more reward than it deserves.

Virgin's Bower

Gold-thread

Cowslip

Pasque Flower

While the Twenty-third Psalm takes us "beside the still waters" we find no reference to the buttercups that may well have been growing there. In fact, we have found no reference to any member of the buttercup family in *The Bible*. This is strange because the plants are conspicuous and are widespread over the world.

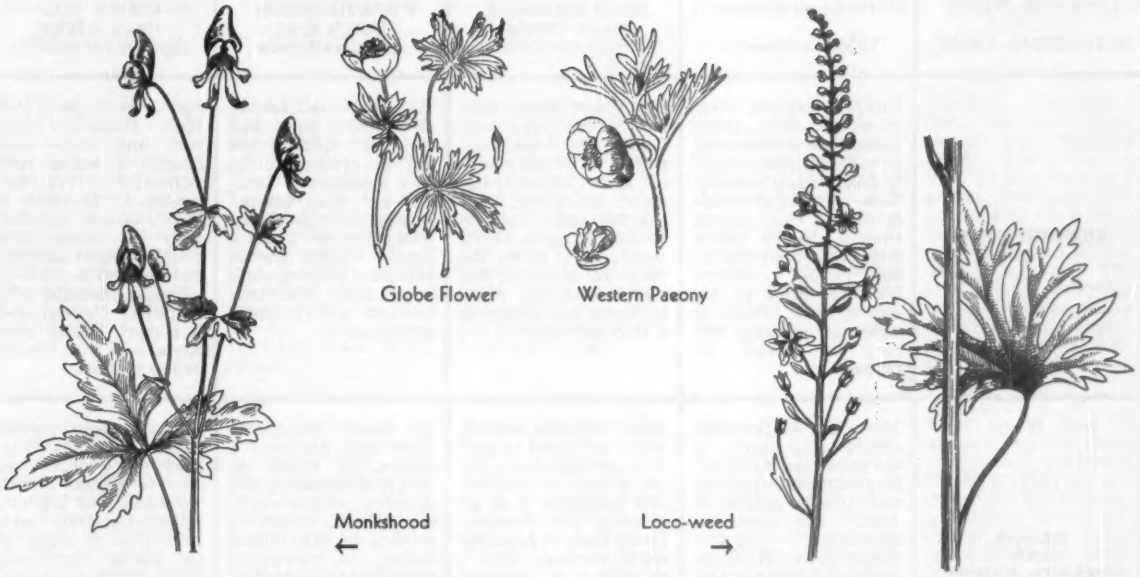
Let us leave the poets now and consider what the buttercups might mean to the doctor, the farmer, the business man, and the professional botanist. Each has found something of real value in this group of plants. Some of it may be new to you.

Reference to the chart section of this insert will give some details on the real and assumed medicinal importance of some of the plants of our group. Our native wild peony, or Christmas rose, is reputed by some to have value in "strengthening the wind" of horses to which it is fed. There may be some reason for questioning this, and certainly with the decline in the importance of horses this supposed virtue of the plant is not likely to be further investigated.

The powdered underground parts of black snakeroot have long been thought by some to have value in curing rheumatism. This has been questioned, but the supposed effective element was a resin containing cimicifugin. The role of the plant as an insect repellent can be questioned, too, and it is probably not poisonous.

Since there seem to be well-recorded cases of death to children being caused by the eating of white baneberry fruits we cannot pass this over lightly. Even adults have been adversely affected by eating as few as six of the attractive berries, which look so much like dolls' eyes. The element here is a violent purgative and affects the heart, so the plant should be recognized by all.

From goldenseal we get a white alkaloid, hydrastine, and the yellow alkaloid, berberine, which give a bitter tonic and astringent used in the treatment of catarrhal ailments. There is an established market for this material. Of much less importance, probably, are the medicinal properties to be found in Christmas rose. Our wild hellebore, which may cause severe skin trouble, is not related to the



Christmas rose of the genus *Helleborus*. The little gold thread, whose yellow roots are so intriguing, is often used to improve the appetite but how effective it may really be may be questioned somewhat. It probably does no harm.

The European monkshood, which belongs in the buttercup family, gives us the alkaloid, aconitum, which is used officinally in the treatment of fevers, as an irritant and as an anaesthetic. It should be used with great care as over-dosages may cause serious trouble. Another dangerous alkaloid, delphinine, comes from one of our delphiniums and may seriously affect grazing cattle and sheep where the forage is poor in spring.

So many of us have eaten cowslip greens in spring that we may be surprised to know that uncooked cowslips, eaten by man or beast, may cause unwanted trouble. Fortunately cooking of the greens destroys the harmful nature of the plant material.

Buttercups of the genus *Ranunculus* may cause a skin rash in humans and affect the milk and intestinal condition of cattle, but this is not true of all members of the genus.

The beautiful pasque flower of early spring prairies is reputed to cure nerve exhaustion with women under certain conditions, but the same element may cause colic and other troubles.

Our attractive little hepaticas were once considered to have medicinal properties probably based largely on the conviction that plants with leaves shaped like a human organ were useful in curing diseases of that organ. If there should be anything to this philosophy, we might recognize the hepatica as yielding a cure for liver trouble. You make your own decision in this case.

Farmers, of course, are interested in many non-crop plants that grow in their fields. Members of the buttercup family figure here. Fortunately almost all of the buttercups thus involved cannot withstand heavy competition from other plants, and many cannot survive severe cutting. So ordinary farm practices usually keep the problem under easy control. While cattle that eat green field buttercups may be harmed, they are not ordinarily affected if they eat hay made from the same plants. Apparently drying destroys the harmful elements.

False Rue Anemone

Christmas Rose

Without question the most menacing member of the buttercup family, so far as some farmers are concerned, is the locoweed, one of the delphiniums. In many cases this plant can be cared for by controlling the time and place of grazing of domestic animals.

Some farmers may be interested in some of the buttercup group because of the soil preferences of the plants. The chart section of this insert may be helpful in this connection. Read, for example, how the two common hepaticas may be used as indicators of sour or of limey soils.

Farmers for the most part have some appreciation of beauty, and it is quite possible that to some the gay flowers of many of the buttercup group make life more worthwhile than would be the case had these folk been required to live in urban surroundings. I am sure that, to me at least, a field of buttercups is more pleasing than a creek or lake below many industrial plants, sewage disposal plants or mine dumps.

Of course the business man's happiness frequently depends largely on the prosperity and general success of the farmer. Many business men create markets for members of the buttercup group, which may help business. This commercial aspect may come from many sources. Of course cattle or human (*continued on page 256*)

COMMON NAME SCIENTIFIC NAME	WESTERN PAEONY *Paeonia brownii*	BLACK SNAKEROOT BLACK COHOSH *Cimicifuga racemosa*	WHITE BANEBERRY DOLL'S EYES *Actaea pachypoda*	GOLDEN SEAL ORANGE-ROOT *Hydrastis canadensis*
DESCRIPTION	Leaves smooth, rich green, not shiny, alternate; when crushed may have skunk odor; mostly basal, many coarsely three-parted and usually deeply cut. Stems smooth, to 20 inches long, somewhat succulent, with a bloom. Underground parts, coarse, thick, woody or tuberous, perennial and may be divided for propagation.	To 8 feet high, with most leaves near top. Leaves, 2-3 times compound, with leaflets to 3 or more inches long, round to oblong, and coarsely and sharply toothed margins, thick, smooth, light green, the whole leaf appearing like a great open fan. Stem is slender but rootstock is thick and heavy.	To 32 inches tall. Leaves of 3 major parts and each part divided once or twice, giving plant an open appearance. Leaflets are with sharper lobes in white baneberry than in the red. Leaflets usually wholly smooth beneath. Fruiting stalk is terminal. Rootstock is coarse and virulently poisonous.	Stem, erect, to 1 foot high. Single leaf from root, and single stem bearing 2 leaves near summit. Stem unbranched. Leaves to 8 inches across, rounded, with 5-9 lobes, with doubly toothed margins, palmately 5-nerved, widening gradually with maturity. Underground is a short, knotty horizontal root with fibrous yellow rootlets.
RANGE AND RELATIONSHIP	More than 30 perennial shrubs or sub-shrubs in the genus, mostly of the Northern Hemisphere and mostly native of Asia. One American species, *P. brownii*, ranges from Washington to California in Canadian and Hudsonian zones, east slopes of Cascades and Blue Mountains and Sierra Nevada, east to Utah and south to southern California.	Some 10 species, most of which are found in gardens as ornamentals. All are found in northern cool temperate areas of America and Eurasia. In the East, in America, are *C. racemosa*, with 1 to rarely 3 stalkless ovaries like *C. elata* of West, and *C. americana*, with 3-8 stalked ovaries like *C. laciniata* of West. Woodland plants.	In North Temperate Zone there are some 7 species, of which *A. pachypoda*, white b., and *A. rubra*, red b. are eastern and *A. arguta* is western in the United States. *A. pachypoda* ranges from eastern Quebec to Minnesota and south to Georgia, Louisiana and Oklahoma. Western; Alaska to central California.	One American species ranges from New England to Georgia and west to Kansas in rich woodlands, but is grown rather extensively under cultivation in shade in the Pacific Northwest, found north to Minnesota. There is one other related species found in Japan. Probably best known is the cultivated *H. canadensis*.
REPRODUCTION	Flowers to 1½-inch across, nodding, with 5-6, greenish, ½-inch sepals and equal number of deep red petals streaked with maroon or yellow, often to black. Stamens numerous, dull yellow. Pistils usually 5, green developing into many seeded, thick, leathery pods that are smooth and conspicuous and cause stems to droop.	*C. racemosa*, with 4-5 petal-like sepals, but less conspicuous than the numerous white stamens. Flowers arranged as feathery tufts along the erect, slender stem. Fruit berry-like and purple and seeds rough. Flowers from June through August, with the western *C. elata* of Washington and Oregon flowering June-July. Chromosomes, 16.	Flowers in crowded, long, terminal clusters of 3-5 petal-like sepals, each to 1/6-inch long and with numerous stamens. Petals 4-10. Fruiting stalk or pedicel about as thick as stalk that bears them. In red b., they are more slender. Fruit usually spherical and white, often with red or purple cap giving doll's eye appearance.	Flowers to 1/3-inch across, composed of 3 greenish-white sepals, which drop early. No petals. Stamens numerous. Carpels to 12 or more each bearing 1-2 seeds eventually and ripening into reddish berry-like units that fuse into a head which when mature, is to 2/3-inch through. Seeds do not survive drying. Chromosomes, 26.
ECOLOGY	Blooms in South in January and known there as Christmas rose. May be found blooming at edge of snow in mountains, or in hot plains to the South. Root is believed by some to have medicinal value particularly when fed to horses to "strengthen their wind." Named in honor of Paion, the physician of the gods. Chromosomes, 10.	Pollination caused by insects, largely greenish flesh-flies that may be attracted by odor. Name *Cimicifuga* means a driver away of bedbugs, but whether this is effective or not may be questioned. *C. racemosa* ranges from Maine to Georgia and west to Wisconsin and Missouri, and to 4000-foot elevation in North Carolina.	Favors rich woodlands and up to 5000-foot altitude in Virginia. Flowers from April to June, pollination being by small bees such as *Halictus*. Berries feed caterpillars of one of azure butterflies. Poisonous properties found in both European and American baneberries, particularly in rootstock but also in berries. Chromosomes, 16.	Roots contain poisonous or medicinal alkaloids, hydrastine, berberine and canadine, of which hydrastine is most active. These may cause catarrhal mucous inflamation and ulcers if eaten, and are to be found in leaves as well as in roots. Grown in shade in woods well supplied with leaf mold, bone meal, cottonseed meal and potash.
ECONOMY	Genus best known by the common garden paeonies, or pineys, which, as herbs, have developed from *Paeonia lactiflora* and considered as *P. anomala* by some. Flowers of *P. anomala*, crimson; of *P. albiflora*, white or pink; of *P. tenuifolia*, crimson to purple; of *P. officinalis*, crimson to white. Tree paeonias are P. *suffruticosa*.	Here beauty triumphs over scent and a foul-smelling plant placed far enough away from a path brings satisfaction because of the attractiveness of the great, feathery, frond-like leaves. This plant is not listed in the poisonous plant category, as are a number of its relatives, in spite of the common name, "bugbane."	Poison is a violent purgative, emetic and irritant and affects the heart. Children known to have died after eating the berries, and adults eating as few as 6 berries have suffered with dizziness, colic, burning of the stomach and an increase in the pulse rate. Known also as necklace weed, rattlesnakewort and grapewort.	Fruits are sown in fall in moist sand after pulp is removed. Seedlings are transplanted into lath houses and roots may reach maturity at 4 years costing about $2000 or more to establish an acre depending on circumstances. There is a sustained domestic market of about 300,000 pounds a year.

EARLY MEADOW RUE *Thalictrum dioicum*	GLOBE FLOWER *Trollius laxus*	CHRISTMAS ROSE *Helleborus niger*	GOLDTHREAD, SAVOYANE *Coptis groenlandica*	COLUMBINE ROCKBELLS *Aquilegia canadensis*
To 30 inches high. Perennial. Slender, tough, branched, smooth, pale green stems. Leaves 2 or more times compounded, of thin, pale, widely separated leaflets. Leaves are long-petioled. Leaflets of 3-9 lobes. Flowers appear above the uppermost leaves. Root system is fibrous and not yellow.	Height to 20 inches. Stems erect or ascending. Lower leaves with long petioles, sometimes 1 foot long, with blades 3-5 parted, to 4 inches across. Basal leaves, 1-3. Stem leaves, 1-3, without petioles. Flowers are solitary, at the top of the stem, sometimes somewhat crowded by the upper leaves. Perennial. Weak. Roots fibrous.	Stemless except for flower stalk which is unbranched, or sometimes branched once. Single leaf is irregularly divided into lobes, which may be toothed near tip. Petiole, to 7 inches long and erect. Leaves, evergreen, leathery and green. Rootstock, short, with short, brittle rootlets that are black and 1/10-inch through.	Total height, rarely to 5 inches, represented by the one-flowered scape Leaves, evergreen, 3-parted or 3 leaflets each sharply toothed and short petioled, shiny green, and with rather conspicuous veins. Roots slender, bright yellow and almost thread-like, bitter and of medicinal value. Perennial herbs.	Height to more than 3 feet, the stems being slender and relatively tough. Leaves increasingly smaller from base to top, with lower compound and of 3 main parts, smooth, often pale green and with leaflets usually crowded. The root system penetrates the soil deeply where possible and permits plant to survive ordinary drought seasons.
Most of the approximately 120 species are found in the North Temperate Zone, some in Andes of South America, India and South Africa. About 20 species in North America. *T. dioicum* ranges from Quebec to Georgia and Alabama and west to Manitoba, Missouri and Kentucky. Also recorded from Labrador.	Some 15 species of the genus found in North Temperate Zone with one under common cultivation and 7 others sometimes cultivated. *T. laxus* ranges from Connecticut to Delaware and west to Michigan and Ohio. Its range is extended to British Columbia, the Olympics, the Cascades and Wenatchee and on to Utah in white-flowered form.	This is a European plant found under cultivation and is not our wild hellebore, *Veratrum*, found in swampy areas. There are at least 8 species that are natives of Europe and western Asia and almost all have a number of recognized varieties growing under cultivation. *H. orientale*, with green to purple flowers, is from Asia Minor.	About 10 species found in the cooler North Temperate Zone. The Asiatic and Alaskan *C. trifolia* has leaflets without petioles and flowers with narrower petals. *C. groenlandica* ranges from southern Greenland and Labrador to Manitoba and south to Newfoundland, Nova Scotia, New Jersey and Tennessee in mountains.	There are at least 70 wild species of the genus and many cultivated varieties. They are native of the North Temperate Zone, but in cultivated form are found in gardens the world over. *A. canadensis* ranges from Nova Scotia to Georgia and west at least to Tennessee, with close relatives extending on to the West.
Plants bear either staminate or pistillate flowers, the staminate looking like pale yellowish-green lace and the pistillate rather inconspicuous pale green. There are no petals and the few sepals drop off early. Flowers appear about with leaves of deciduous trees. Fruits about 1/6-inch long, ribbed conspicuously, straight.	Flowers cream to almost white, to 1½ inches across. Sepals, 5-7, yellow-green. Petals, shorter than the stamens, 15-25. Sepals are conspicuous part of flower. Stamens very numerous but are also shorter than the showy sepals. Anthers ½-inch long. Fruit cluster to 1 inch across, of follicles to 2/5-inch long.	Flowers are usually solitary, and white to pale purple, borne on flowering stems to 18 inches long that bear small leaves or bracts with clasping bases. Flowers to 2½ inches across, with petals shorter than the stamens, inconspicuous and tubular. Showy parts are sepals. 3-10 pistils developing into leathery follicles.	Flowers resemble small blackberry flowers, with 5-7 petal-like sepals that are shed early and 5-7 fleshy, hollow-tipped petals. Stamens are 15-29 and pistils are 3-9. Fruits are spreading follicles borne at the tips of short, slender stalks. Seeds fill about ⅓ of the follicle of the fruit and are round in section.	Flowers are abundant, nodding, red and yellow, to 1½-inch across, conspicuous because of straight spurs to ¾-inch long. Stamens are many and end at the spur openings and are contacted by nectar-seeking insects, which help in pollination. Fruits are finely fuzzy, to 1 inch long, and split down one side to free the seeds.
Pollination effected probably by wind in April and May. The different species favor different habitats, with *T. Polygamum* of East favoring damp open areas. A southern species is appropriately named "maid of the mist." Chromosome number, 42; in related *T. dasycarpum*, 28, 42; *T. polygamum*, 154; *T. revolutum*, 133.	Grows in swampy places or wet meadows. Flowers appear in May and June. Differ most conspicuously from the buttercups, *Ranunculus*, by the follicles that split down one side in preference to the one-seeded achenes of the buttercups. Nectar is borne in special sacs at the base of petals. Self or insect pollination is common.	All species bloom in first mild days of the winter and before spring. May be forced under glass to bloom at almost any time of the winter. Usual propagation is by division of roots in fall or spring. Seeds should be planted on reaching maturity and should yield flowers the 3rd season. Chromosome number 32.	Favors soil with a pH of 4-5 but it must always be cool and moist and generally is in the shade of evergreens. Has a slight odor. Seeds planted when ripened germinate the first spring and may produce flowers 2nd year. Plants may be divided in spring for planting in gardens. Chromosome number of *C. japonica* is 18.	Favors soil with a pH of 5-7.5 where there is an abundance of moisture within reach of the deep root system. Flowers appear in May and June, and fruits may mature seeds during early summer. This species is the source of hybrids, with blue-flowered type under cultivation. Chromosome number is 14. Sepals are 2 and they drop early.
A garden species of *Thalictrum* has been developed from Asiatic and European species. Most species of the genus may be reproduced easily by division of underground parts because of shortness of time to produce results. Soil should usually be well-drained and loamy in texture, although this is not always the case.	Globe-flowers of the gardens are commonly used as border plants. They are popular because of their flowers and because they may grow in ground too wet for some other garden flowers. They are multiplied by seeds or by dividing underground parts during resting season. Chromosomes in *T. europaeus* 16.	Besides being a popular garden and hothouse ornamental, the plant's rootstock yields a drug, which may be poisonous if eaten or may be used as medicine as a diuretic, or cathartic, and is used in the treatment of dropsy, hysteria and melancholia. The dosage of the fluid extract is 2-10 drops.	Roots yield a bitter tonic and is prepared as a powder of the root. It promotes digestion by improving the appetite, serves as a general stimulant and is considered on the whole as being beneficial. The typical dosage, when used medicinally, is 10-20 grains. To many, greatest value lies in a glimpse of the golden roots.	This is the State Flower of Colorado. The flowers are of little value in bouquets as they wilt quickly, and, anyway, they are much more attractive growing in their natural habitat. Cultivated columbine is grown from seed at 2 pounds of seed per acre in rows 20 inches apart with plants thinned to 12 inches apart. Seed sown late summer.

COMMON NAME SCIENTIFIC NAME	WILD MONKSHOOD *Aconitum uncinatum*	POISON LARKSPUR LOCOWEED *Delphinium scopularum* var. *glaucum*	FALSE RUE ANEMONE *Isopyrum biternatum*	MARSH MARIGOLD COWSLIP *Caltha palustris*
DESCRIPTION	Height to 5 feet, weak but may climb. Leaves rather stiff, deeply 3-5 lobed, with the lobes rather deeply toothed. Leaves numerous along the stem, alternate, to 4 inches wide. Root is substantial and tuberous, poisonous if eaten. In *A. napellus*, root is blackish, conical above, and tapering below, with 5-7 angled core.	Height, to 6 feet, with smooth stems, well supplied with leaves and arising from a stout woody root. Leaves are to 6 inches across, 5-7 parted, with the division deeply and sharply cut, but with the central segment most conspicuous. If tops are eaten by cattle, unfortunate developments take place.	Stem to 16 inches long, slender, erect or ascending, branched. Basal leaves on long petioles, and divided into 3, each in turn similarly divided. Stem leaves without the basal petiole of basal leaves. Roots fibrous, and bearing many small, tuber-like structures of various sizes and shapes.	Height to 2 feet, with plant forming great clumps, sometimes to 2 feet or more through. Stems hollow, succulent, angularly branched above, and rich dark green. Leaves long petioled, with kidney-shaped blades, to 8 inches across, smooth, bright rich green. Underground roots soft and spongy, with many rootlets.
RANGE AND RELATIONSHIP	About 80 species, mostly native of North Temperate Zone and mostly in Asia. In United States, there are commonly recognized 3 eastern and 1 western species, as well as those that are introduced. *A. uncinatum* ranges from Pennsylvania to Georgia and west to Kentucky, with related species extending to the west and north.	Some 126 species of the genus found mostly in the Northern Hemisphere and in western South America. This species ranges from Alaska to southern California and east to the mountains. Some species are annual while others are biennial or perennial. There are a number of varieties of the species, most of which are local.	About 30 species in the genus of which 3 occur in the western states, and *I. biternatum* ranges through the East from southern Ontario to western Florida and west to Minnesota and Arkansas. Western species include *I. occidentale*, of limited range in California; *I. hallii*, of limited range in Oregon, and *I. stipitatum*, of limited range in Oregon and California.	About 20 species of the genus are known both from the northern and the southern hemispheres, but all in cool or cold areas. There are two species in the eastern United States and a half dozen in the western States. The other eastern species is *C. natans*, which has slender floating leaves and pink or white flowers.
REPRODUCTION	Flowers borne in few-flowered clusters, on smooth stems, with the upper portions fuzzy. Flowers are blue, to more than 1 inch broad, with 5 sepals and the upper two conspicuous. Pistils, 3, several seeded and to nearly ½-inch long. Flowers appear in mid-summer. Fruits appear in late summer. Chromosome number is 16.	Flowers borne on a long erect axis with the lowermost opening and maturing first, the whole cluster sometimes to 20 inches long. Sepals are light to dark purple, to ½-inch long. Upper petals are notched and purple-tipped. Fruiting follicles are to 2/5-inch long, nearly straight, and usually smooth. Seeds, winged at top.	Flowers are white, to ¾-inch across, without petals, but with usually 5 petal-like sepals and numerous stamens with small globular anthers. Pistils few, usually 4, which spread from each other, are somewhat egg-shaped and compressed. Seeds are relatively few and are roughened in some species at least.	Flowers are to 1½-inch across, shallow cup-shaped, bright yellow. Petals are absent but the sepals numbering usually 5 are petal-like and drop off early. Stamens are numerous and pistils number from 3-12 or even more, are to 1 inch long when mature, and split down one side freeing many seeds. Pollination by bees and flies.
ECOLOGY	The drug, aconite, comes, for the most part, from European plants, but these are cultivated in America, although to a lesser extent. The root of *A. napellus* if tasted lightly gives a tingling sensation followed in about 2 minutes by numbness. Under expert guidance, it is used in treatment of croup, ulcerated tonsils and in sedation.	Poisoning of cattle comes largely from grazing soon after snow has left and other forage is not available. Sheep may be poisoned by over-feeding on young plants. Poison is an alkaloid, delphinoidine mostly, or others including the most virulent delphinine. Different species vary in poisons they produce.	In the related *I. fumarioides*, the chromosome number is 14. *I. biternatum* bears flowers in April and May, with the flowers usually at the tips of the stem or of its branches. The genus is not listed in the usual lists of economic plants, or in lists of medicinal plants as are so many of its relatives.	Green parts contain the poisonous alkaloid, jervine, and the glucoside, helleborin, both of which are destroyed by cooking. Sheep and cattle may be poisoned by eating green parts. Plants are perennial. Chromosome number is 32, 48 or 56. Soil preference is pH 5-7. Flowering time is April through May.
ECONOMY	Great care should be taken to avoid overdosage. Treatment, if this happens, is to give an emetic, or to use ether or ammonia, but this ordinarily is dangerous. Under cultivation, seeds are sown in fall, in well-drained soil and roots are harvested the second season after tops have died back.	In range, this plant may be most dangerous to animals grazing in early season. Symptoms include loss of appetite, nausea, bloating, constipation, rigidity in limbs, and similar behavior and developments. In some areas, the plant may be of great economic importance because of its effect on cattle, sheep and horses in spring.	Probably of little or no economic importance but is merely, for our purposes, an attractive little flower that is not even conspicuous.	Eating of green plants may cause diarrhoea and milk stoppage in cattle, as well as stomach stoppage. The cooked greens are eaten widely by human beings with safety. Buds may be picked and par-boiled in saturated salt solution for use as pickles, but first water should be poured off. Heat destroys the poisonous elements here.

BITTER BUTTERCUP *Ranunculus acris*	PASQUE FLOWER *Anemone patens*	HEPATICA, LIVERLEAF *Hepatica acutiloba*	RUE ANEMONE *Anemonella thalictroides*	VIRGIN'S BOWER *Clematis virginiana*
To 3 feet or more high, with branched, hollow, relatively tough, erect stems. Upper leaves, 3-parted and without basic petioles ordinarily. Lower leaves on long petioles, composed of 5-7 parts radiating from a common source, often with somewhat sticky hairs that may cause a rash on some persons.	Height to 16 inches. Stems erect or ascending, branching, densely covered with hairs that may be light green to gray. Basal leaves may be many, with long petioles, with blades somewhat kidney shaped or round but abundantly and deeply cut repeatedly, the segments being slender. Root system is substantial. Plants are perennial.	Low herb with flowers borne at end of scapes and leaves from a basal cluster. Leaves are thick, three-lobed, with pointed lobe tips and long hairy petioles. Lobes of *H. acutiloba* are pointed; of *H. america*, blunt. Perennial, with a coarsely fibrous root system. Leaves may persist through winter under snow.	To 8 inches tall, with stems bearing a crown of a whorl of compound leaves whose parts may be to ¾-inch across and appear to be shallowly, 3-lobed at the tips. In addition to leaves borne on the stems, there are essentially similar basal leaves. Cluster of elliptic tuberous roots.	More or less woody climbing vine that may be many yards long and climb over trees and shrubs, or more particularly over sunny walls and fences. Leaves of 3 leaflets, each with broad base and deeply lobed tip, nearly smooth. Leaves and leaflet may coil about the supporting stem over which the plant grows.
There are about 300 species in this genus, mostly of the cool or colder north temperate areas. They vary in size, habitat and general ecology so have wide representation in one form or another. *R. acris* was introduced into United States from Europe. Ranges from Newfoundland to British Columbia, south to Missouri.	About 100 species in the genus and most in northern temperate and Arctic areas. This species ranges from Alaska to Texas, east to Illinois and Wisconsin. It is also found in Eurasia. The species is highly variable, and many races and varieties are recognized by those who seek them.	There are 6 species in the northern hemisphere in the temperate parts. Closely related to *Anemone*, which has divided leaves rather than the lobed leaves of *Hepatica*. Both *H. acutiloba* and *H. americana* are listed as cultivated plants for use in flower gardens, and both range Quebec to Minnesota and south to Missouri and Georgia.	There is but one species in this genus and this is it, and it is found only in eastern North America where it ranges from New Hampshire to Florida and west to Minnesota and Kansas. It favors woodlands where the cover is not too thick and where it will not itself be too crowded.	There are more than a hundred species of the genus varying from herbs to woody vines. The leaves of all are opposite but may be simple or compound. This species ranges from Nova Scotia to Georgia and west to Manitoba and Tennessee. Some of the cultivated species have brilliantly attractive flowers.
Flowers are shallow, yellow cups, to 1 inch across, with 5 yellow sepals, about 2-3 times the length of the green sepals, and much broader. Stamens are numerous, and pistils are abundant, developing into 1-seeded achenes that are compressed and have a short beak. Pollinated for the most part by insects.	Sepals are purple to white and petal-like, to 1½-inch long and conspicuous. They number 5-7, are blunt at the tips. There are no true petals. Stamens are numerous and attractive. The many pistils mature to form a thimble-shaped head, which splits to show fluffy individual fruits. Chromosome number is 16.	Flowers appear immediately after snow is gone, are borne singly at end of flowering scapes. Scapes are hairy and to 6 inches high. Petals absent but replaced by to 15 colored sepals with green involucre appearing to be a calyx. Stamens are numerous and separate, as are the pistils, which develop into 1-seeded, pointed fruits.	Flowers are borne above the stem leaves of the "involucre" and may be to 5 or more. There are to 10, petal-like sepals that are white to pale purple and to more than ½-inch long and spreading. Stamens are numerous, but true petals are lacking. Fistils number to about a dozen and are narrow. They ripen into dry achenes and may bear 8-10 longitudinal ribs.	Flowers are white or greenish-white and relatively inconspicuous. They appear in open clusters and some may bear pistils only, while others bear pistils and stamens, but the two kinds are usually on separate plants. Sepals are 4 and greenish-white. No petals. Stamens many. Pistils develop conspicuously.
Flowers in May through October. Green parts may be poisonous to cattle but lose this quality when dried into hay. Poison affects cattle, horses and sheep, producing bitter and sometimes reddish milk and an inflamation of the intestines. Normally buttercups are rejected by grazing animals. Chromosomes, 14, 16, 18, 28.	Essentially a plant of the prairies, blooming at the break of spring or usually in April. This is the State Flower of South Dakota. The plants yield medicinal qualities which are used to cure nerve exhaustion, particularly in women because of menstrual troubles and may cause catarrhal troubles and colic.	A tannin extracted with alcohol from leaves has some astringent properties but no great medicinal value. In past, was believed to have value in correcting liver troubles partly on the superstition that plants with leaves shaped like human organs had medicinal value in helping those organs to keep healthy.	Soil favored has an acidity of pH 5-6 but plant will tolerate more acid soil. Plants may be transplanted easily and safely or the plants may be propagated by seeds that are sown at ripening time. Seedlings appear the first year and the 2nd year the plant may flower.	Flowering time is from July to September and pollination may be effected by bees and flies attracted by abundant nectar, or, in some species, by showy flowers. From October on, the fruits appear as fluffy gray balls loosely put together, giving the plant the common name of old man's beard.
Rejection by grazing animals permits development and reproduction of buttercups and a natural increase in their abundance. Plants will not survive cutting and draining, nor do they do well in competition with other plants that thrive in well-fertilized soil so they may be controlled by good pasture management.	It is more pleasant to think of the satisfaction one's soul gets from seeing the flowers than to think of their medicinal properties, which may or may not be real. Plants are grown as ornamental in suitable garden soil and sunlight and may be grown from seeds sown ripe in spring or by dividing the root systems in spring following fruiting.	This is the State Flower of Missouri. It survives transplanting into home gardens well. *H. americana* favors acid soils and *H. acutiloba* limey soils, so may be used as some suggestion of the nature of the soils on which they are found growing.	Roots are edible and taste somewhat like potatoes, but the amount gained does not justify the destruction of such beautiful plants except in cases of starvation. Roots are high in their starch content. Commonly found in association with oak and hickory. Flowering time is May and June ordinarily.	This species may well be cultivated as an ornamental and to increase the impenetrability of a natural hedge. It may be propagated easily by burying sections of the vine or by rooting sections of the vine and then replanting the sections.

(*Continued from page 251*) beings whose health is affected by their contacts with buttercups may affect the local economy through decreased production of flesh, milk, or work. This is a natural situation. The sale of drugs, and the production of those drugs that find their origin in some buttercup, may be of economic importance in limited areas.

Possibly the greatest economic return from the buttercup group comes from the culture, development and sale of members of the group whose flowers are attractive and have a sale value. The production of bizarre forms of plants that bloom at unusual times or in unusual places, of plants that resist the attacks of insects and funguses, of plants that give a quick or a lasting return for a small amount of effort on man's part have a special commercial value that business men have recognized.

When you visit your supermarket take a look at the counter where flower seeds are offered for sale. Surely you will find there some plants whose genus is listed in our chart section this month. The production and sale of these seeds is good business and calls for fine understanding of the amount of seeds that can be sold for a given price, and the cost of producing the seeds in the envelope you see on display in your store. As is the case in most business ventures, rewards go to those who give the best services in the long run. If then you do get satisfaction from the flower seeds you sow, the chances are that, over the years, you will gain respect for the name of some seedsman and that respect may lead to his commercial success.

I am reasonably certain that, wherever you may live, there will be some place where you find it convenient to purchase some cut flowers for use as decoration in your home. Offhand I can name two or three farms within a few miles of our home where I am sure I shall make a visit at my wife's direction this summer, and from which we will depart with a few plants for which I will have made a generous payment in good cold cash. I well remember a visit we made a few years ago to Canada, where we were greatly pleased by a gift from a friend of a wonderful clump of buttercups. We glowed with the thought of how they would look in our garden; that is, we did until we came to the border. There a man in a uniform took one look at the plants and politely asked us to take them out and leave them by the roadside. I am almost willing to bet that they now are doing well in his own flower garden. We might have been sore about it, but I recognized the importance of plant quarantine and, of course, went along with the ruling of the officer. For that matter, what else could I have done? Without such protection, serious difficulties might arise in this country we like so well.

To the botanist, the Family Ranunculaceae is most interesting. While the poet speaks generally, the botanist recognizes and even creates many fine and real differences. Some botanists would not include peonies in the buttercup family, but would put them in a family by themselves. They have good reasons but they are not important here.

Botanists who have been interested in phylogeny, or the ancestry of plants, have had a field day with the family. With reason, the family is now recognized as one of the most primitive of the dicots, based in part on the obvious lack of specialization of parts and the independence of the sets of parts. Fused parts of any set or of sets themselves is usually the exception to the rule.

The types of pollination found in the family vary greatly and are shown by some variations in the flowers. Self-pollination is relatively common in some of the plants where the stamens and pistils grow closely together. Wind pollination is obvious in the lacy flowers of such plants as the meadow rues. Insect pollination is common and the plants use attractive color, color patterns, some fragrances, special corolla shapes to attract some insects and to repel other insects, depending on the service they render in achieving pollination. Nectar is made available freely, or is hidden where it must be sought in different members of the family. In a columbine, for example, the nectar may be hidden deeply where it may ordinarily be reached only by special structures. In this case, of course, the pollen-producing stamens and the pollen-receiving stigmas are placed where and when they can profit by the visit of the pollen seekers.

Ecologists find in the buttercup family a variety of interesting things to note. Many of these are suggested in the charts where water needs and chemical needs are discussed for the eighteen genera considered. Time of flowering and of maturing seeds is reflected in the geographical distribution of some of the members of the family. Christmas rose, which blooms early, has a different range than that found for the late-blooming types. The aquatic members of the family, of course, have structures different from those that must survive on dry land, so possibly, if we wished, we could make a rather complete understanding of the needs of plants in general if we could but understand well the problems of the Family Ranunculaceae.

In view of the importance of this family, it is rather surprising that so few of its members have appeared in the first ninety-five of these special inserts. The 39th insert considered the wild columbine, the marsh marigold, the hepatica and the bitter buttercup, all of which are represented in the current unit. The 46th insert presented the garden columbine, and the 56th gave us the water buttercup. It might seem from this that, on the whole, the family does not play an important role in the economic affairs of men where food, fiber, fuel, flavors and fancy are given high rank in determining worth.

In soil preferences, most of the members of the family are neutral, or close to neutral. They may be found in bloom over a wide range of territory, from early spring until early winter. Representatives of the family are to be found growing submerged in water to areas of at least semidesert condition, from high in the mountains to near sea level, in the cracks in city pavements and in the most remote wilderness regions, in blazing sunlight to the subdued light of the densest evergreen forest.

A Partnership with Potential

An Editorial

CORDIAL yet urgent invitation to all organizations interested in wildlife conservation "to join with soil conservation districts in a potent working relationship that will benefit all land resources and all users of these resources," was issued by D. A. Williams, Administrator of the U.S. Soil Conservation Service, in an important address to the recent Twenty-third North American Wildlife Conference in St. Louis.

Taking his basic theme from the often-quoted statement of Aldo Leopold, who defined conservation simply as "a state of harmony between men and land," Dr. Williams declared that such a state "is gained only by great effort and maintained only by great vigilance."

"Conservation of the soil, water, grass, timber and wildlife resources of our country," he asserted, "is a constant, uphill struggle against the many forces and influences which man and nature oppose to that harmony Leopold used as a definition and measure of conservation." And he voiced the firm conviction "that a large part of the solution can be found in the field of agriculture and in the hands of the private owners and operators of land."

Dr. Williams asked who determines land use, and therefore the use of its component elements of soil, water, grass, trees and wildlife. He answered by pointing out that four-fifths of all our land is in farms, or is used for grazing by farmers or ranchers. "Most of our water falls on agricultural land and is therefore first of all an agricultural resource. Most of our timber grows on privately owned land."

"Thus," the speaker continued, "any approach to the land of necessity must be mainly through its use for agriculture, and through the attitudes and actions of the men and women who, under our cherished American system, have great latitude in the management of their affairs and their property, including land."

Carrying the basic land resource farther, Dr. Williams declared that four-fifths of the game species of wildlife are produced on land under private control. Agriculture, he said, alters habitats but also creates new habitats, and "there is probably more wildlife today than when our forefathers saw our land."

"As you travel almost anywhere in our country today, you can see the evidences of conservation progress based on a new concept of conservation. Modern soil and water conservation means putting to work on the land needed combinations of effective practices—combinations planned for and fitted to each acre of land according to the use for which that land is best suited.

"Such a land-use pattern, that respects the natural capabilities of the land, of necessity includes a place for wildlife. Some land, uniquely suited to wildlife, is permanently dedicated to that use. The farm or ranch, planned and managed as a whole, produces wildlife as a primary crop of such areas, and as a by-product of the entire land unit."

Dr. Williams reviewed the contributions of varied groups to progress in conservation. He cited the work of the Soil Conservation Service and the small watershed approach, which has gained such rapid ground. Private industry and private groups of many kinds have contributed their important part to appreciation of conservation need.

"But," the speaker went on, "conservation progress stems from something more. The existence, in the form of soil conservation districts, of *organized*, local conservation effort by farmers and ranchers has, in my opinion, been the single greatest factor in the distance we have traveled thus far toward conservation of our total land resources.

"Conceived 20 years ago as a hopeful experiment in the mechanics of operating a national soil and water conservation program, these soil conservation districts—2779 of them today—have emerged as a unique example of successful local leadership of a program that must involve participation of government at local, state and national levels, as well as other segments of society—all focusing on the farmer and his land."

It is, in fact, amazing to realize that in two decades the soil conservation district program has grown to embrace 93 percent of all farms and ranches and about 88 percent of the farm land. There are 1,728,000 cooperators with the districts. Having attained such eminence and success, Dr. Williams declared, these districts are "more than a useful mechanism for channeling education, technical and other conservation programs to the land." More than that, he said, the districts as a body constitute "a tremendous, vital, local, conservation-minded segment of the agricultural population of the United States. Its governing bodies alone comprise some 14,000 local conservation leaders who, in turn, are banded together state by state and nationally into a group whose voice for conservation is strong and growing stronger."

It was in the light of these facts, and the opportunity he sees for a still greater potential for conservation, that Dr. Williams issued his urgent invitation for partnership. He underlined this invitation with the assertion:

"I know of no other approach to the solution of basic soil, water and wildlife conservation problems that can equal the potential of such a partnership." ❦ ❦ ❦

U. S. FISH AND WILDLIFE SERVICE

Voice of the Wolf

The stream must be crossed, but this wolf pup in Mt. McKinley National Park seems to have as much aversion to water as have many young humans.

A FEW YEARS ago, I became seriously concerned by the thought that, although I had spent my early years in wolf country, and had since wandered through it as a vacationing naturalist, I had never heard a wolf howl. Wilderness stories were full of howling wolves, and some knowing modern writers were beginning to say that the wolf was a vanishing animal, already confined to remote hinterlands that were destined to shrink even more rapidly in an atomic world. So it seemed that if I were ever going to hear a wolf, the time was now, especially as I lived only an hour's drive from Algonquin Provincial Park, in Ontario, Canada, which supports within its 3000 square miles of wilderness the most southerly permanent population of timber wolves left in North America.

I learned that a friend of mine, Abbott Conway, also of Huntsville, Ontario, was as interested as I was, so we decided to combine our bird-watching and bird-banding with wolf-listening, and went to work. Abbott already had heard wolves once, and we thought that the area in which he had heard them would be a good starting point. It turned out to be a fortunate choice, for it was on the home territory of a pack, or family of wolves. Woodsmen that we consulted were skeptical of our success. Most of them had heard wolves, but they assured us there was no way of knowing when or where to listen. This we found to be largely true. The "home territory" of a wolf pack may be twenty miles across, and there is no certainty about hearing them even if you should camp for days on their range.

We began by brushing up on our knowledge of wolves in general, and turned up much curious information. We learned that the gray wolf, *Canis lupus*, of which the timber wolf is one of many sub-species, originally had the widest range of any large land mammal (completely around the Northern Hemisphere); that it has had a bounty on its head for a longer period than any other animal (since the days of the early Greeks, some 3000 years ago); and that it has been the subject of more fables, legends, tall tales, and just plain nonsense than any other single species, human or animal. We were convinced also—and to prove this was one of the objects of our listening—that few items of wolf lore have been treated with more exaggeration than those

These tracks in the snow were made by a pack of five wolves on the frozen surface of a small lake. The scattered tracks were made when the wolves were leaving for a night's hunting, while the furrow-like mark on the right is the return trail, when they trotted or walked in single file, stepping in each other's footprints. From one of these trails alone it is impossible to say how many are in the pack.

By RUSSELL J. RUTTER

Photographs by the Author unless otherwise credited

From this shelter in Ontario's Algonquin Provincial Park, the author and his friend set out on their wolf-listening expedition.

about its voice. With few exceptions, references in the literature implied that it went about howling out of pure cussedness, commonly selecting for the delivery of its "fearful lament," gruesome cry," or "dismal howl," (quotations) some stark hilltop, preferably on a cold, moonlit, winter night.

Well, we found the wolves, and we think we have lived with them and listened to them enough to justify a report. As most wild mammals, wolves generally are silent, and even if you are within hearing of a pack, you have not more than one minute out of each twenty-four hours in which to hear them. In the matter of voice, they have a quite remarkable characteristic not shared by any other North American mammal. They are the only ones that deliberately sing, that is, raise their voices in loud and sustained sound for no apparent reason other than the production of the sound itself. If you doubt this, run through a list of the mammals and see if you can find one that produces any noticeable sound not connected with mating, alarm, or hunting. Also, this "singing" is done, not singly, but in an organized group. When a lone wolf howls, it is for some other purpose than the production of sound.

This is an exact copy of an entry from my field note-book. "September 7, Saturday. Fine day, Cape May warblers around in the morning but no birds caught. (One of our activities here was bird-banding.) Finished frame of shelter we had been working on. Followed old road to Airy Lake in afternoon and explored part of old railway grade. Very fine expedition. Got back at 7:15. At 8:20 pack of wolves howled (Raja Lake) and were answered by lone wolf at Bone Lake. At about 8:40 all howled together from vicinity of Bone Lake. Fine performance. Whippoorwill and horned owl joined wolves as full moon rose, making the evening complete."

There we have the most commonly heard wolf sounds, and they may be interpreted as follows: Wolves usually rest during the day and hunt at night, and the members of a pack ordinarily spend the day in the same general vicinity. Some time in the evening, and the hour is quite variable, they prepare for the night's hunt; and a wolf pack going hunting is as well organized as a platoon of trained soldiers. Before they go, they get together for a friendly session of sniffing and tail-wagging; then one of them raises its muzzle and howls, another joins in at a different pitch, then another and another, and for fifteen or twenty seconds their wild harmony rolls over the surrounding country, to delight or terrify, depending on the listener. As far as other wildlife goes, there is good evidence that it pays no attention whatever, unless it be to respond with a song of its own, as the whippoorwill and horned owl did. Even deer continue to feed as if they did not hear, having learned long ago that a wolf howl does not tell which way the wolves are going.

It might be fairly argued here that this is a hunting call and not a song, until we find out that when the wolves return in the morning—and they often do come back to where they started from—they go through the whole ceremony again before settling down for the day. It would be difficult to see what practical purpose this morning song could serve, unless it was to give away their daytime position to possible enemies. I think it was Thoreau who first drew attention to the curious fact that some animals, such as the rabbit, which are practically voiceless all their lives, often cry out when faced with imminent death, and suggested that we cannot rule out the possibility that some primitive religious instinct is involved. The Huntsville wolf-listeners like to think of the wolves sending up their morning and evening hymns to the only friend they know, the Great Spirit of the wilderness. Unimaginative scientists may laugh, but they have no better explanation.

The lone wolf howl in my note-book entry was the rallying or muster call from the leader of the pack. It is a long, low-pitched howl, quite unlike anything heard in the chorus, and may be interrupted by deep-toned barks, similar to those of a large dog. It is used when the leader is separated from the pack and wishes to bring them together. In this case, he evidently had gone off somewhere on business of his own, and on his return

to the resting area—perhaps because he was tired, for wolves do get tired—had curled up for the day a half-mile short of where the pack was lying. Before he got around to calling them up in the evening, they had become impatient and started to howl on their own, whereupon he broke in to let them know where he was. Twenty minutes later they joined him, and we listened to the most joyous get-together that we have ever heard.

The first pack chorus at Raja Lake was about a mile from our camp, the leader's position less than half that

Here the wolves turned aside to investigate two beaver lodges in the edge of a flooded swamp beside the lake. The lodge in the background was occupied, but it was frozen solid, and the wolves did not waste much time on it.

far. Ordinarily, a single wolf would go to join the pack, but the leader's dignity must be preserved, so he just sat down and waited, and we had almost a ringside seat for the second performance. This was punctuated by such yelps and whines of joy at the reunion that we found ourselves laughing, even though we were about to crawl into our bedrolls with no protection but the the little square of tarpaulin used to keep off the dew and unexpected showers. That answers the question of whether we think wolves will attack a human being. We do not think they will, or, for that matter, that they ever did; but we could not help thinking that similar circumstances involving different people might easily result in one of those lurid wolf stories so dear to newspapers. The wolves were drawing closer—their hideous cries were louder and wilder the second time than the first, so we should have climbed a tree; but we just went to bed, sure in the conviction that we were safe.

Wolves produce other sounds, the most interesting of which is the mating or lonesome howl, which is confined to lone wolves looking for company. In our experience, it is seldom heard in well-organized wolf country, simply because there are no lone wolves. If might best be described by saying that it sounds like the howl of a dog that is confined, or lonely, or sick, or moved by some strange sound, such as music; and this can be a rather unearthly sound, indeed. Add to this the circumstances under which you are likely to hear it from a wolf, and the human imagination will do the rest. All wolf sounds are similar to those that might be produced by large dogs in the same circumstances, but heard as they usually are, in a wild place, in the dusk of evening or morning, or at night, there is no doubt about their eerie quality. The sound of a wolf chorus at a distance seems to pervade the air in a strange, ventriloquial way, making it difficult to place the exact position. Far from being fearful, gruesome, or dismal, it seems to us to have a quality of sad loneliness, as if it came from one of the lost tribes—as indeed it does—mourning their inevitable fate. The first time Abbott Conway heard it, he was alone, on a dark November evening, and he said afterward that it made him think of a company of wailing women.

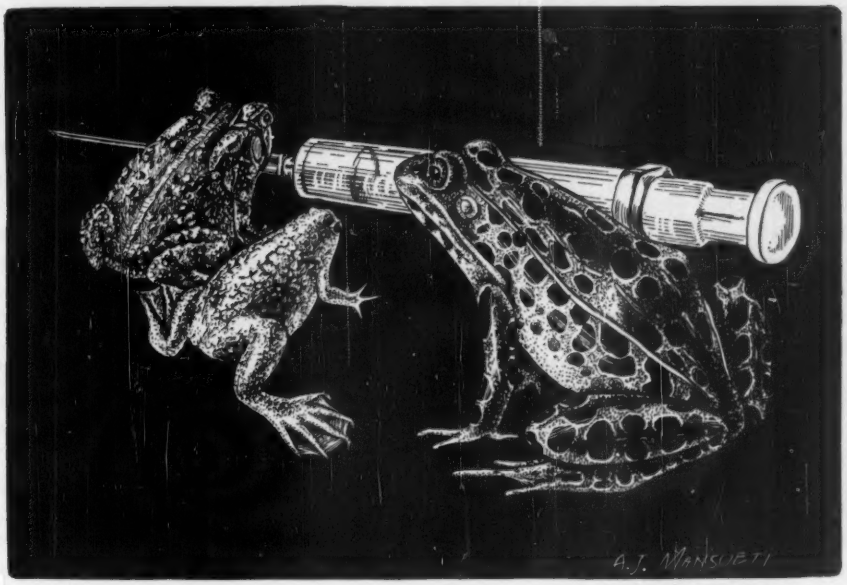
Is extinction really the inevitable fate of the wolf? Unless there is a complete change in our attitude towards it, the answer must be "yes." It is on the verge of extinction now in the United States, and in Canada is confined to regions that are not readily accessible. The centuries-old prejudice against it arose from the simple fact that it was a large, intelligent carnivore, occupying the same range as man in the north temperate zone; and man himself being highly carnivorous, it was not possible for both to continue to live in the same place at the same time. Our present-day attitude is a carry-over from the days when the wolf was a serious competitor for the meat supply, a situation that no longer exists. Yet bounties are still paid yearly on hundreds of wolves taken from areas so remote that they can be reached only by canoe, dog-team, or airplane. It seems like senseless vindictiveness, as though the survivors of a defeated enemy were being hunted down for the sins of their ancestors.

The Huntsville wolf-listeners have learned just how much the song of the wolf can add to that wilderness which many of us are trying to preserve, because we believe it is necessary to a balanced civilization. We think that all true believers in wilderness will need to be more vocal in the wolf's behalf if an unreasoning public sentiment against it is ever to be overcome, and we hope that this account of our own experience may inspire others to take up the challenge in the fight for the preservation of the wolf.

STARS

By Ethel Jacobson

Crystal fish
Caught in the seine
Of the trawler, Night.



DRAWING BY ALICE JANE MANSUETI

The American toad, at the far left, the South African clawed toad, center, and the leopard or grass frog, at the right, are among the primitive vertebrates that have played an important role in medical science in recent years.

Medical science is indebted to

The Doctor's Little Helpers

By ROMEO MANSUETI

JEAN ROSTAND, renowned biologist and son of France's famed playwright Edmond Rostand, author of *Cyrano de Bergerac*, once remarked, "In my frogs, I see the entire universe."

The meaning of this cryptic remark is interwoven somehow in his unique biological investigations on frogs and toads. Perhaps this philosophical musing was designed to suggest that these creatures embody and reflect the scheme of life as seen in higher animals and man. If this is true, then I am sure that many people who have dissected preserved frogs in school probably will agree.

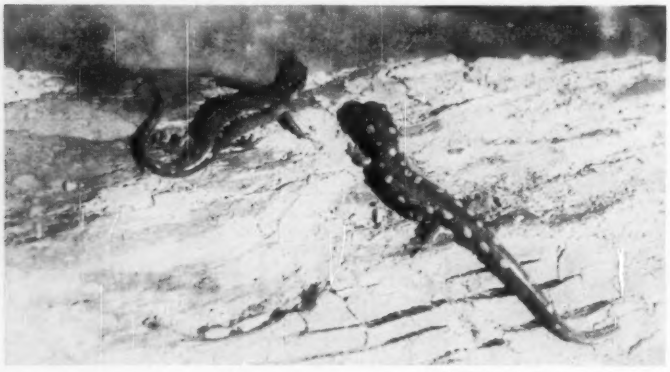
We owe a great deal to these primitive, yet marvelous, vertebrates. What person does not owe his first introduction into anatomy and physiology to frogs? Many of us can remember as children that new worlds opened up for us as we watched the hatching of frog's eggs from the jelly masses, and the transformation of frogs from polliwogs. In recent years, however, few people have been aware of a much more important role that frogs, toads and salamanders are playing in the service of medical science and humanity.

Frogs and their relatives have many well-known virtues in their relations with mankind. As a boy intensely interested in capturing frogs, I was surprised to hear that dried toads and frogs were sold in China for medicinal purposes. Earlier, I had been told that they were essential ingredients in the brews of witches, although by age nine I sloughed off the story as poppycock. All the frogs that I kept as pets were confirmed insect-eaters, and therefore of great potential benefit to mankind. When I conveyed these facts to older naturalists of my acquaintance, they hardly batted an eyelash; such facts were "old hat."

The acquaintance that the great majority of people have with these amphibians is not a close one. They have heard it said that frogs and toads are the farmer's best friends, because they eat harmful bugs. They know, too, that fried frog's-legs are considered delicacies, and are expensive. But one of the things that many people do not know is that the ordinary "grass frog" is regarded today by most obstetricians in our hospitals as an important assistant in their work.

This all began in 1934, when two doctors, tiring of the use of rabbits in the expensive, long and complicated method of early pregnancy detection, decided instead to experiment with different species of amphibians. They used the female South African clawed toad, *Xenopus laevis*. By injecting the urine containing sex hormones of pregnant women into these frogs, eggs were extruded —a phenomenon that indicated pregnancy. If no eggs were produced, the lady apparently was not expecting.

In 1937, Dr. Robert Rugh, a famous embryologist, followed this important discovery by describing the rapid excretion of spermatozoa from male frogs when they were injected with the urine of a pregnant woman. South America, in 1947, was the first region to use these toads in pregnancy diagnosis on a large scale in physicians' offices and hospital clinics. Dr. C. Galli-Mainini, probably inspired by Rugh's work, also demonstrated that male frogs, and more especially the male South American toad, *Bufo arenarum*, were excellent pregnancy indicators. In fact, he showed it to be a highly accurate, rapid and simple means of diagnosing pregnancy, obtaining more than ninety-eight percent accuracy in more than two thousand tests.



PHOTOGRAPH BY L. W. BROWNELL

Salamanders like the above illustrated specimens have become important tools in medical research, especially in the field of cancer study. Dried salamanders were once reported to have been used by the Japanese as a vermifuge.

In 1949, I visited a man who was a dealer in clawed toads, Jay E. Cook, of Baltimore, Maryland, who was at the time the only large-scale importer of them in the western hemisphere, and who had established a business of shipping the animals by air to hospitals and laboratories all over the Americas. In addition to their use in early pregnancy tests, these toads, in the tadpole stage, were also used clinically for thyroid assay. Mr. Cook showed me his tanks, containing more than ten thousand of the toads. When he presented me with two of the exotic creatures, I was overjoyed. As pets, they provided me and my herpetologically inclined friends with many hours of enjoyment and pleasure.

By this time, you may wonder what grass frogs have to do with these tests, if clawed and South American toads are used in laboratories. The answer is that American scientists were credited with a major breakthrough in this problem in 1948. The grass frog, or leopard frog, *Rana pipiens*, is a cheap and abundant laboratory animal, well known to millions of students. As a result of studies by Drs. P. B. Wiltberger, D. F. Miller, S. L. Robbins, and F. Parker, it became a major test animal for pregnancy diagnosis. No other frog is as versatile as the leopard frog in its martyrdom to science. During the early studies, scientists found that male leopard frogs were not as accurate indicators of pregnancy as the South American toad, but the development of more precise techniques improved the reactions. In recent years, for example, biologists have found that the use of blood serum, which has a greater concentration of sex hormones than does urine, has increased the accuracy of pregnancy tests. Thus, nowdays, it is a widely used diagnostic tool in clinical laboratories in North America. A well-known biological supply house, for example, listed in its 1957-58 catalogue: "male grass frogs—for use in pregnancy tests," as follows: "one dozen, $7.50; one hundred, $60.00." Since the market is geared for male frogs, one problem is to distinguish between sexes. This is not easily done except during spring months, and then only an expert can do it. There are no seasonal variations of sensitivity in the frogs to the sex hormones, an important advantage in their favor. Thus, any time during the year a physician can get results in a matter of hours from this simple, rapid and cheap test.

Actually, this test can probably be conducted on most species of frogs and toads in North America. Physicians in Colorado, for example, have reported that two local species, the American toad, *Bufo americanus*, and Woodhouse's toad, *B. woodhousi*, made excellent test animals.

I recall the time when newspaper headlines screamed, "Biologist sees possibility of an all-women world." The gist of this statement was based on the feat accomplished by Dr. Emil Witschi, of the University of Iowa, in raising frogs from males only —eliminating, in this case, any need for females. Dr. Witschi and his associate, Dr. C. Y. Chang, carried out their sex-reversing work by bathing the male embryos of the clawed toad in one of the female sex hormones. These later developed into egg-producing females. The change occurred without alteration of the animal's male hereditary constitution. Eggs of these sex-reversed males, when fertilized by sperm of a non-reversed brother, or any other normal male, were all males when they hatched from the eggs.

What does all this have to do with an all-women world? Well, for one thing, these scientists demonstrated that they could control the sex of an animal. They showed that any of the eggs from sex-reversed males can be made females by the addition of the female sex hormones. They claimed, therefore, that they could

dispense with the true genetic females, and they speculated that in man the reverse would be true, since the human male produces the germ cells that govern the sex of offspring. Thus, the genetic father among humans could be eliminated, and women could hold sway!

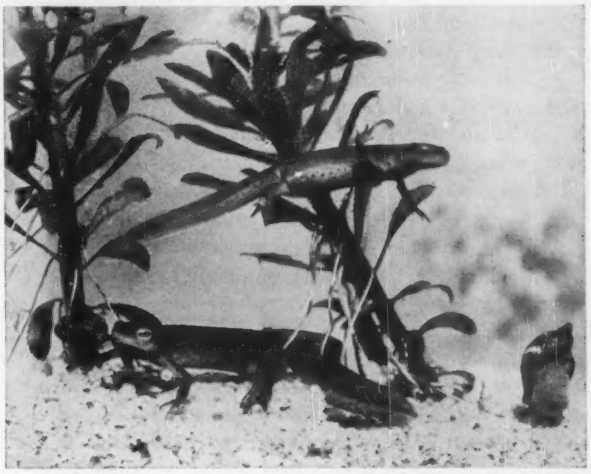
But let us return to some of the more conventional uses of amphibians in experimental biology and medical science. It is a long leap from frogs to humans, but progress apparently has not been hampered much by the gap. Leonardo da Vinci had said, when he conducted his crude but important yeoman's service in anatomy in the early sixteenth century, "The frog instantly dies when the spinal cord is pierced; and previous to this it lived without head without heart or any bowels or intestines or skin; and here therefore it would seem lies the foundation of movement and life." Luigi Galvani, in the mid-eighteenth century, carried the ball with his classic experiments with electrical phenomena in the frog, and opened the way toward clarifying the mystery of form, function and life.

Then there is the work of Dr. Marcus Singer, a neuroanatomist at Harvard Medical School. He knew, of course, that newts and salamanders can grow new legs and tails with the greatest of ease. Tadpoles can do the trick, too, but when they transform into frogs, they can no longer regenerate new limbs. Why the more complex frog body was unable to accomplish this feat perplexed the scientist. To answer the question, he cut the big sciatic nerves out of the hind legs of twenty-one amputee frogs, folded them back under the skin, and connected them to the stumps of the frogs' amputated front legs. Dr. Singer was astounded to find that in twenty ot the frogs, a new foreleg began to grow within three weeks. "One can become wild with speculation as to the significance of this discovery," he cried. But, he hastened to add, ". . . This work may remain in the realm of abstract reason for many years." His modesty prevented him from implying that this work may be of great significance in the further development of work toward successfully treating human nervous disorders.

Salamanders, themselves, rarely have been used as any sort of medicinal agent, although the late Dr. Emmett Reid Dunn once reported that dried salamanders are employed as a vermifuge by the Japanese. Recently, work with salamanders has provided valuable clues to the vagaries of cancer. Dr. Charles Breedis, a cancer specialist of the University of Pennsylvania School of Medicine, was aware of the fact that if you injected a cancer-producing agent and also limb tissues capable of regeneration into the forelimbs of a newt, *Triturus viridescens*, certain interesting changes resulted.

The most important observation resulting from such injections was the production of malignant tumors in only two animals out of 500 test salamanders. Dr. Breedis duplicated this type of experiment by injecting fractions of coal tar products. These induced the formation of accessory limbs in a substantial number of his newts where the cancer-producing agent was injected. He concluded that cancer-producing agents can not only make tumors grow, but normal limbs as well. These facts made many other cancer specialists sit up and take notice, and provided the stimulus for many similar type experiments that may aid in the amelioration of suffering among cancer victims.

Still another example might be cited in which salamanders contributed to the knowledge of cancer. It is a known fact that almost every conceivable surgical operation can be performed on a salamander, with results that can be startling. Dr. Gerhard Frankhauser, of Princeton University, performed an extraordinary experiment when he doubled the genes of salamanders by raising and lowering the temperature fifteen degrees. By further variation of temperature, he produced salamanders with three, four and even seven sets of chromosomes, instead of the normal two sets. Even though supplied with extra chromosomes, the salamanders remain normal size, but their cells are giants. Extra chromosomes cause both plants and their cells to grow to abnormal size. The facts as observed in animals and plants are of great importance in cancer research, for when control over growth is lost, normal cells turn into cancer cells.



PHOTOGRAPH BY L. W. BROWNELL

The common newt, *Triturus viridescens*, has been involved in a number of investigations into the production of malignant tumors by means of coal tar products.

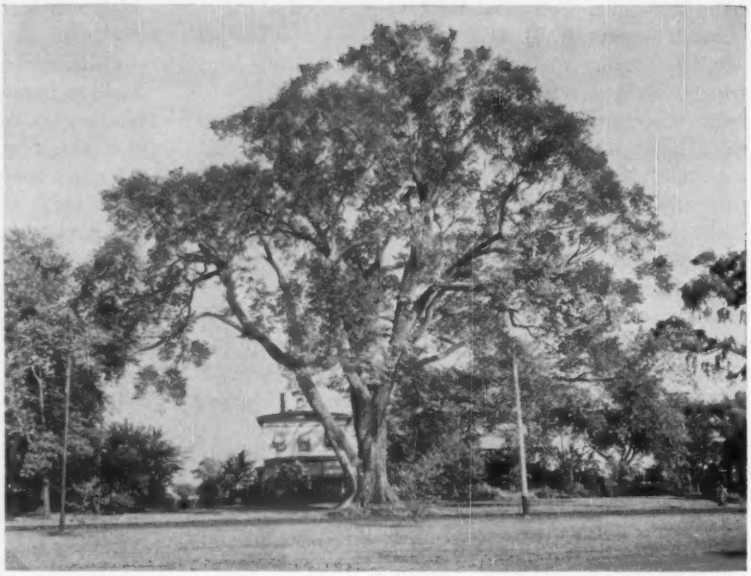
I can recall a day, not long ago, when a friend and I set out on a frog-hunting expedition to a nearby swamp. To while away the time as we walked, I recounted to my friend the contributions that have been made to medical science by frogs, toads and salamanders. After he had caught his first frog, my friend held it closely and squinted at its gold-flecked eyes for a few moments. Finally he said, "You know, you little rascal, after all the work your sisters and brothers have done for us, the least I can do is to turn you loose." And before I could protest, he plopped the frog into the water, where it dove out of sight.

Green Fountain

By RUTH H. DUDLEY

IN THE history of our country, the American elm, *Ulmus americana*, has had, for a silent actor, perhaps a more than ordinarily active part to play. It was growing here when the Pilgrims first set foot on the shores of Massachusetts, and was a witness to the difficulties of the early settlers of New England. When later the pioneers pushed west, they took with them seeds and young trees of the elm, planting them wherever they made their new homes; so that the American elm followed the march of civilization into almost all the territory that was later to become the States of the Union.

Its seeds are carried easily by wind and water, and they sprout and thrive under many conditions of soil and climate. It is at home from Newfoundland to Florida and Texas, and west to Nebraska and the Dakotas, especially along river and stream beds. It skips the high country of the Rocky Mountain States, but is found again on the Pacific Coast.



UNITED STATES FOREST SERVICE

The Wethersfield elm, at Wethersfield, Connecticut, is thought to be the largest elm in New England. It is more than a hundred feet in height, and has a diameter of nine feet and six inches.

Almost every State, and many towns and cities, have their favorite or famous American elms. In earliest times, before town halls became commonplace, shady elms often served as meeting places for the population; and many were the historical events to which they were witnesses. William Penn made his famous treaty with the Indians under such a wide-spreading elm, and under the Washington Elm at Cambridge, Massachusetts, General Washington is said to have taken command of the Continental Army in 1775. Connecticut has its famous whipping-post elm, where early settlers were punished for their misbehavior. Kansans are proud of their Lincoln Memorial Tree, where crowds once gathered to hear Abraham Lincoln speak. The Justice Tree in Missouri sheltered judges while they held court; and the list of such historic elms is a long one.

In general, the American elm may be identified by its familiar vase-shape. However, there are several modifications of this general shape—in the "oak" form, the branches are heavy and wide-spreading, like those of the oak. In the "plume" form, the tree has two or three main limbs that stretch quite high before branching out in a plume-like spray. Often most of the trunks and limbs are covered with a fringe of short, feathery twigs. The "weeping" form has a short trunk with long drooping branches, reminiscent of the weeping willow.

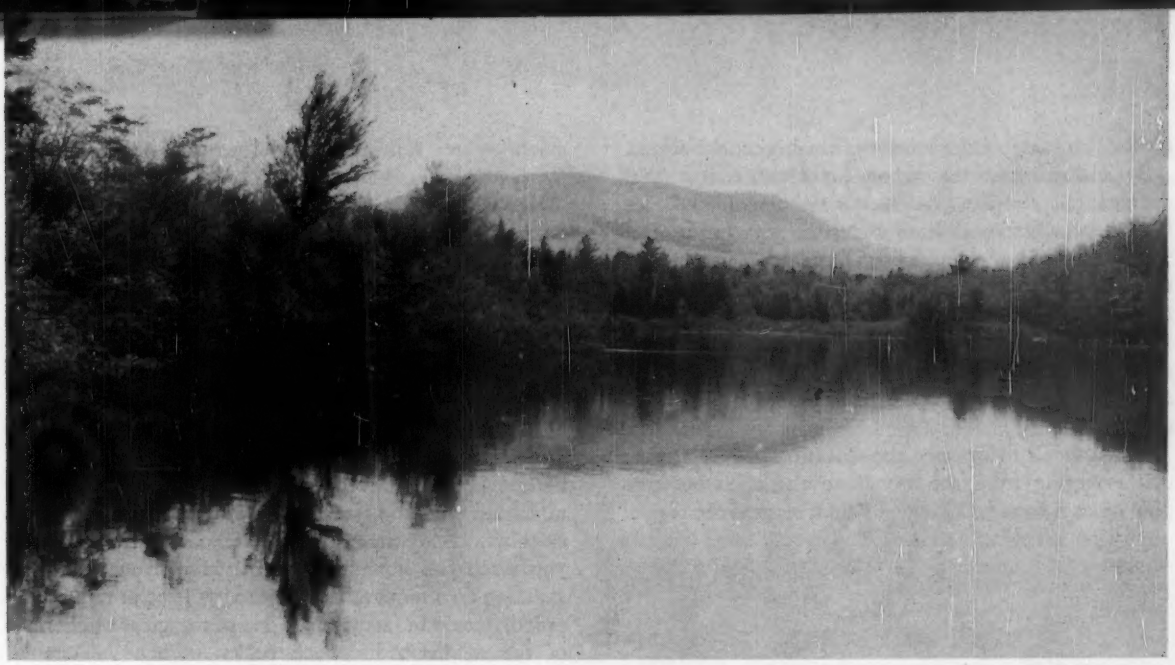
The wood of the American elm is strong, and many a farm lad has fallen into the habit of throwing it aside until the better-splitting specimens in the kitchen woodpile have been worked up. But early Americans found that elm made stout wagon-wheel hubs and barn flooring, and it has been used also in the shipbuilding trade.

Of the eighteen known species of elm, six are native to this country; and so well-known and loved is the American elm that the people of three States—Massachusetts, Nebraska and North Dakota—have adopted it as a State tree.

MAY APPLES

By May Allread Baker

In spring they show umbrellas green and gay,
The lovely, waxen blooms appear in May.
And when the petals fall, through sun and rain
The oval pellets of the fruit remain
To grow, and ripen, through the summer days.
But if you seek them, down the woodland ways,
And find the pulpy fruit no special treat—
These apples have a fragrance wild and sweet.



The nameless little mountains and quiet ponds of the wilder areas of the Adirondacks offer a sense of intimate association with Nature that somehow cannot be obtained from the more rugged mountain scenery of the West.

Little Mountains Are Worth Climbing!

By ROBERT G. SNYDER

It was a sunny afternoon in mid-March. I could not do any outside work around home because my wife had reserved that particular day for taking the portraits of some deer that were in the habit of coming to feed on the branches of a big balsam tree we had cut in the back yard. My presence would only make her appointed task more difficult, so I decided to go in search of a little group of white birch trees that I had once spotted.

These trees were in a little ravine on the northwesterly slope of a nearby mountain. I strapped on my snowshoes and started out. The snowshoeing was perfect, there being a heavy crust covered with about two inches of soft powder snow. In only a matter of minutes, I had reached the base of the mountain, and had wound my way up to the lower end of the ravine, stopping once on the way for a breather where a small, rocky ledge afforded an intimate glimpse of the nearby landscape.

I found the birches. There were a dozen of them in a family group. The larger ones had their feet firmly planted near a run-off brook in the bottom of the glen; the rest had taken precarious toe-holds along the face of a little ledge nearby. They presented a winter scene of rare grace and beauty, the late afternoon sun glowing warmly on their smooth, creamy boles, with the contrasting dark green spruces in the background. A[illegible] above all, there was the deep blue sky so peculiar to [illegible] winter days in clear weather. White birches, also known as canoe or paper birches, are common in many places in the Adirondacks. But they happen to be almost absent in our valley, so I thrilled to the sight of the dozen trees that, as far as I knew, were known only to me. Their very presence there on the mountainside was an interesting mystery, as they were several miles from their nearest kin.

The sun was still more than an hour high, so I decided to continue on up to the peak of the mountain, since I had orders not to return and disturb the deer until darkness precluded the taking of pictures.

Winter still had a firm grip on the Adirondacks. The snow was three to five feet deep, making the traveling much easier than it would have been at other times of the year, as the thick brush and many windfalls were buried under the smooth blanket. The main difficulty was a tendency to slide backwards, or sidewards, on the steeper pitches. The woods were silent and the snow was unbroken, save for a few red squirrel tracks, and the trails of two adventurous deer that had taken advantage of the firm crust to climb out of their valley wintering

grounds and sample the browse of the higher elevations.

By following a somewhat circuitous course that avoided the steepest grades, I was soon at the top. Buried in jackstraw fashion under the snow at my feet were the trunks of hundreds of felled spruce trees, victims of the 1950 hurricane that vented its full fury on the crests and eastern slopes of many Adirondack peaks. I worked my way to the very edge of the pitch-off that dropped sharply before me, in violent contrast to the comparatively gentle slope I had climbed on the back side.

It is difficult to describe the sensation one feels when first emerging from the woods to the open outcropping of an Adirondack ridge. Below me was the ragged

At some time during the geologic past, molten granite boiled up into the ancient metamorphosed rocks of the Adirondacks. Today, stripped of its overburden by the erosion of ages, a granite "bubble" with a typical sheeted face offers a challenge to the nonprofessional climber. For the less adventurous, most of the "little mountains" offer at least one easy route to their summits.

shoreline of a white, snow-blanketed lake, with two miniature, wooded islands. So near were they that I could see each individual white pine tree, although trees I knew to be a hundred feet tall were reduced to matchstick proportions. Across a sharp, narrow valley to my right was another ridge that seemed, in the crystal clear air, to be almost close enough for me to reach with a running jump. And beyond, in all directions, were more mountains, and glimpses of other lakes and ponds in sheltered valleys. The stillness was unmarred by human activity; I felt more like a worshipper than a sightseer, as I thought of the words someone had once laboriously carved into the bare rock at the top of a much greater Adirondack eminence: *Thanks be to God for the Mountains.*

Not all the Adirondack mountains are small—at least, not by Eastern standards. Mount Marcy (unfortunately, the old Indian name *Tahawus*—"He splits the sky"—has been abandoned) stands more than a mile above sea level, and there are several others that approach this height. The grandeur laid out before the eyes of all who climb these higher peaks is common knowledge, and certainly the effort spent in such ascents is worthwhile.

But the little mountains of the Adirondack region also are highly rewarding. Many may be topped in half an hour; some in even less. This does not sound like mountain climbing, you say. But do not judge the results by walking time, nor by figures of elevation. When you reach the summit, you will know you are truly standing on a mountain, even though it be in miniature proportions. In fact, that is one of the greatest charms of the smaller Adirondack peaks. When you stand astride a top, you are not aloof from the many lakes and the countless ridges that surround you; rather, you feel a greater closeness to them. If a nearby lake is ruffled by a breeze, you can see the ripples glinting in the sun; you feel almost as though you could high-dive into its cold, blue waters. But do not be deceived by the clear mountain air—it is farther than you think!

These little mountains are not tame hills, either, that you can saunter up easily from any direction that you choose. True, there is usually at least one fairly gentle route that can be taken to the top of nearly every one. But if approached from the wrong angle, all but the most expert of mountain climbers would be baffled by the steep slopes, sheer rock ledges, and sharp chasms. A perpendicular wall of one hundred or three hundred feet can be just as final as one of a thousand. The Adirondack region is one of the oldest geological formations on earth; it has been battered by the elements, smothered and ground by glacial ice, and generally pounded down to what is called the rounded contours of old age. But these spirited old ranges have apparently never heard of geologists.

One of the advantages of smallness is the number and variety of ridges that a given area can contain. Within the Adirondack Park there are hundreds of such miniature mountains, mostly unnamed, the majority of them visited rather sparingly. There are no paths except animal trails on the slopes of most of the more secluded ridges. Thus, one of the great rewards in making their ascent is found in almost completely losing the civilized world for a while. One can be a Daniel Boone in imagination, an explorer of untamed places. The view from many of these little ridges is inspiring, if only because no sign of human work is evident to the eye, and no sound is heard but the wind in the trees and the harmonious voices of the wild folk who live in the forest. Then, too, one is really exploring, in a sense. For not all the mountains present a view to the climber. The heavy forest cover of the region blankets all but the steepest ledges, and sometimes it is difficult to locate a good

lookout. Often, the only broad view is not from the top at all, but from some hidden little opening on the side. Recent winds, however, have laid many spruce-clad summits bare, to reveal a formerly hidden panorama and perhaps, in a small way, refute the notion that violent storms contain nothing but ill winds.

There are other rewards, aside from the view from the top, for those who would tread among the spruce needles, mosses and ferns of the wild, little ridges. The fragrance of the wood-scented air is exhilarating, especially where the path winds through stands of pungent spruces, or groves of aromatic balsam firs. In the early summer, song birds of many varieties lift the spirit of the adventurer higher than his feet can take him, with their happy hymns to Nature. Here, on the hardwood slopes, is the home of the wood thrush and its cousin the hermit thrush, with a beautiful, haunting song that bespeaks of the wild and lonely places. To descend a mountain at dusk and suddenly hear these pure tones drifting shyly through the columns of birch, beech and maple makes one want to stop and remove the hat in reverent thanksgiving for a wondrous natural cathedral.

As darkness deepens, a great horned owl cries out from a far ridge, and perhaps, way down the valley, a brush wolf answers with his quavering evening wail. Then one must hurry before the failing twilight leaves him stranded for the night away from camp.

Deer are common in the Adirondack woods, and glimpses of them will not be rare if you are quiet. Grouse are often stirred into sudden, hurtling flight from the mountainside by your approach. Black bear feed on the blueberries that cluster about the open ridge tops, and the raspberries and blackberries of lower woodland glades, but in the woods they are shy and rarely seen. Still, the knowledge of their presence makes any mountain ramble seem a little more romantic and adventurous. Red squirrels and chipmunks are abundant. Their chattering and busy scurrying add cheer to the woods. Occasionally, some lucky climber may get a glimpse of one of the other furry inhabitants of the region: red fox, raccoon, fisher, weasel, bobcat, or the rare pine marten. But most likely he will encounter only a sluggish porcupine, ambling along between a favorite hemlock tree and a rocky, mountainside den. If the trail crosses a stream valley, it is likely the work of beaver will be spotted, for they are quite numerous. From the mountain top, the flight of a pair of ospreys may now and then be followed, as they glide without effort high over a valley. And the pileated woodpecker spends much time flying from one ridge to another, his loud, cackling call ringing over the woods winter and summer.

The New York State Forest Preserve, of which Adirondack Park is a part, was set aside through the efforts of many people as a place of rest within a highly developed section of the nation. It is unfortunately true that there are shabby resort areas within its boundaries entirely alien to the spirit of the place. It is true, also, that modern transportation brings increasing numbers of people who neither understand nor appreciate, but who desecrate and degrade.

The Adirondack Park is subject, like other State and national areas that have been set aside for the use of the public, to the occasional attack of commercialism under the guise of "greater use" for the good of "all the people." But the little mountains of the Adirondacks are still well worth climbing. They are still a haven for those who feel close to the out-of-doors, and who love the unspoiled woods and waters, and the mountains big or little!

The shores and waters of bogs and ponds in protected areas of the Adirondacks teem with life during the short, warm summer. This typical tamarack bog in the Archer and Anna Huntington Wildlife Forest west of Lake George is the site of a beaver house.

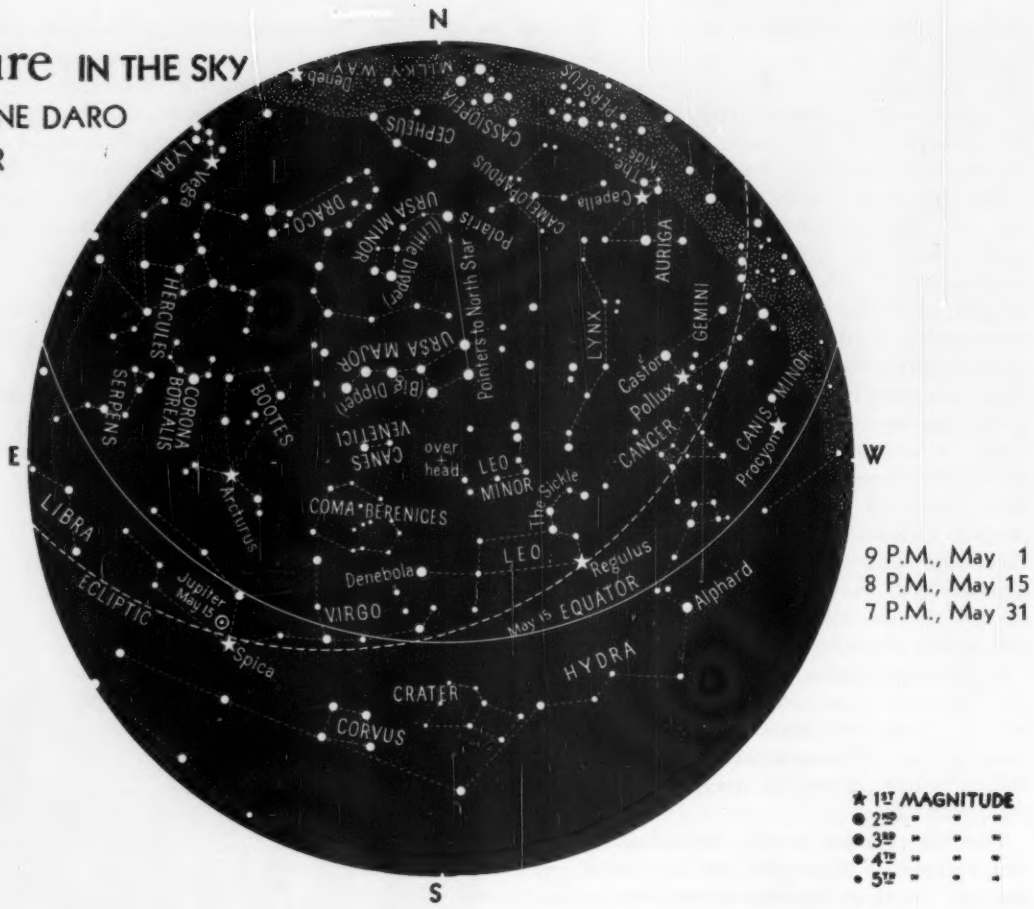
TRANSMUTER

An alchemist is Night
For lo, he has but to enfold
A moon of silver white
And straightway it is gold.

Gladys Ekeberg

Nature IN THE SKY

By SIMONE DARO GOSSNER



To use this map hold it before you in a vertical position and turn it until the direction of the compass that you wish to face is at the bottom. Then, below the center of the map, which is the point overhead, will be seen the constellations visible in that part of the heavens. Times given are for Local Standard Time.

The Crab Nebula

CHARLES MESSIER, who was a hunter of comets (see *Nature Magazine*, May, 1955), was often bothered in his observations by the presence in the sky of nebulous objects. Their appearance easily could be confused with that of a comet, and thus he was forced to do much repetitious checking. In order to dispose of the matter once and for all, he began to compile a catalog of these nebulae.

Number 1 in Messier's catalog was observed in 1758, near Zeta Tauri. He described it as "a whitish light, elongated like the flame of a candle." That is how it looks through a small instrument, but when its structure was revealed by the large telescopes, it was given the name of Crab Nebula, because of the claw-like appearance of its numerous filaments.

Astronomers have been able to establish almost without a doubt that this remarkable object is the remnant of a gigantic stellar explosion known as a supernova. A supernova is an extremely rare phenomenon. Only three such outbursts have been observed in our own galaxy, in 1054 (in Taurus), in 1572 (in Cassiopeia), and in 1604 (in Ophiuchus). The basic difference between a supernova and a nova resides in the violence of the explosion. While a nova may become ten to a hundred thousand times as bright as the sun, the brightness of a supernova may reach several hundred *million* times that of the sun, and may even outshine the whole galaxy in which it occurs. Matter is expelled by the explosion at the rate of at least six thousand miles per second, giving rise to a rapidly expanding shell. This shell continues

to expand until it eventually becomes so tenuous that it can no longer be observed. All that remains in the center is a greatly diminished star, very hot and dense, and resembling the type called "white dwarf."

The first hint that the Crab Nebula may be the remnants of a supernova came in 1913, when V. M. Slipher photographed its spectrum. The procedure involved consists of observing the nebula through a prism, so that its light is decomposed into a rainbow of colored lines. Each line arises from the presence of a definite gaseous element in the nebula. Furthermore, if the gas in the nebula has any motion in the line of sight, the corresponding lines will be displaced; toward the violet if the gas is approaching, and toward the red if the gas is receding. Slipher found that each of the lines ascribed to the Crab Nebula was split in two. Thus, part of the gas was approaching and part of it was receding. His conclusion was, simply enough, that he was dealing with a tremendous expanding mass of gas.

This method, however, reveals only the motion in the line of sight. It still remained to be shown that the nebula is also expanding at right angles to it. This was done conclusively by J. C. Duncan. An excellent photograph of the Crab Nebula had been taken by G. W. Ritchey in 1909, using the 60-inch Mount Wilson telescope. Duncan took a second photograph with the same instrument in 1921. A careful comparison of the two negatives revealed that the outer parts of the nebula were farther away from the center on the 1921 picture than on the one taken in 1909. Although the displacement was very small, it was sufficient to indicate the outward expansion of the gas. The experiment was repeated in 1938, and the prior results were fully confirmed.

Turning back the clock, so to speak, Duncan estimated that if the expansion had taken place at a uniform rate, all the gas in the nebula must have been concentrated in one point some 800 years ago. Precisely at that point, there is a star which has the characteristics generally observed in old novae and supernovae. It is thus reasonable to assume that this star is the "parent" of the Crab Nebula. The only supernova known to have occurred in our galaxy at a time compatible with Duncan's estimate is that of 1054.

There are no known records to indicate that this supernova was ever observed in Europe. It was seen by the Chinese and the Japanese, and duly recorded in the chronicles of the time. We learn from them that the star first appeared on July 4, 1054, and became so bright that it could be seen in daylight. It remained visible for more than a year, until it gradually faded from sight some time in 1056.

From modern observations of the remnants, and from theoretical considerations, N. U. Mayall and J. H. Oort have estimated that the 1054 supernova must have been one of the brightest ever recorded, with a brightness 350 million times that of the sun.

The velocity of expansion in the line of sight has been measured by Mayall, and found to be a little more than 800 miles per second. Comparing this with the angular rate of expansion found by Duncan, and considering that they must be equal, astronomers place the Crab Nebula about 4000 light years away.

Since light from the nebula would take 4000 years to reach us, and since the explosion was seen from earth in 1054, it must have occurred in reality some 5000 years ago. Duncan judged that at the present rate of expansion, the nebula will be completely dissipated and no longer visible from earth around 3000 A.D. We must thank the finite velocity of light for the fact that we are able to view and study a remarkable phenomenon which, in reality, had already run its full course a thousand years before the birth of Christ.

An interesting postscript to the history of the Crab Nebula was written in the July, 1955, leaflet of the Astronomical Society of the Pacific, by W. C. Miller of the Mount Wilson and Palomar Observatories. Dr. Miller reports that in the course of recent archeological surveys conducted by the Museum of Northern Arizona, two unusual astronomical drawings of the Pueblo Indians have been discovered. One was found in a cave located in the White Mesa, the other on a canyon wall on a tributary of Navaho Canyon. With minor differences, they both depict a crescent moon and a circle directly below it. The fact that the crescent is concave to the left at White Mesa, and to the right at Navaho Canyon, has been dismissed as unimportant because even now people are notably unconcerned with astronomical accuracy when they draw a crescent moon.

These pictures attracted immediate attention because the crescent is extremely rare among the drawings found in Northern Arizona. It was assumed, because of their rarity, that they did not depict a common astronomical occurrence. On a hunch, astronomers computed the phase of the moon and its position relative to the supernova on July 4 and 5, 1054. They found that the moon was indeed in crescent phase, about two degrees north of the supernova in the eastern sky, on the morning of July 5. Both cliff sites open to the south and give an unobstructed view of the eastern sky. Furthermore, there is strong archeological evidence that both sites were occupied at that time.

As Dr. Miller points out, the evidence may be only circumstantial, but it is certainly overwhelming. We may well assume that the pueblo drawings are the only known records of the appearance of the 1054 supernova in the western hemisphere.

In the month of May, the moon (*continued on page 276*)

A TELESCOPIC LOOK

The Milky Way is neatly shawled
Upon the curve of the night sky.
A galaxy of stars is walled
To catch the prism-strengthened eye.

We are amazed to see how far
Our vision leaps the stellar slope.
We step across from star to star
With our bright eye, the telescope.

Daniel Smythe

Nature IN THE SCHOOL

By E. LAURENCE PALMER

Professor Emeritus of Nature and Science Education, Cornell University, and Director of Nature Education, The American Nature Association

Buttercups in Schools

INSTEAD OF TELLING you many things this time about the subject of the special insert, I propose telling you about a number of things you may do in your school or home that will help you find out for yourself about our subject. I hope that this will encourage you and others to check up on things you find here and elsewhere, and to develop some self-reliance in a field in which so many feel that they have no stature whatever. There is not the slightest doubt that some people will not favor some of the proposals made. It is quite possible that I may not favor them myself, but the purpose of the suggestions on this page are to get you to exercise your judgment. If you differ with me that may well be exactly what I wish.

This time I propose suggesting a few things you may do that will check up on some of the statements in the special insert on buttercups. These will have to do with the relation of the plants to health, to an understanding of how, in spite of their beauty and possibly their general uselessness at times, they still manage to survive and prosper, and to an understanding of how their appearance, odor and taste affect animals to the advantage of the plants. Most of the suggestions made may be applied to any group of plants, in spite of the fact that here we use, as experimental subjects, members of the buttercup family, the Ranunculaceae.

In various sections of the insert, I suggested that buttercups of one sort or another had properties that might affect our health, that they might be moderately or violently poisonous. I shall not suggest that you experiment at all with any of the seriously dangerous species. Instead, let me suggest that you experiment with some of the less dangerous ones such as the common field buttercup or bitter buttercup illustrated.

Produce a rash

I suggested that the leaves of this plant might produce a rash on the skin of some persons. It will not be so severe as that caused by poison ivy, and it may not affect you personally at all. This does not mean that it may not affect others. Try rubbing some of the leaves of bitter buttercup on your hand to see if it does produce a rash. Try each of the suggestions, first on the palm of your hand, then on the back of your hand, and then on the delicate skin between the fingers. If you get a rash do not continue your experiment, but, if you do not, try other parts of your body. If you continue these experiments you may be able to answer, from direct experience, a few of these questions. Do either the fresh or the dried leaves of bitter buttercup produce a rash if rubbed on some parts of your body? If they do, do they affect all parts of the body the same way? If they do not affect you, do they affect others? Do you feel there is any basis for suggesting that bitter buttercup can produce a skin rash? For your information let me suggest that I do not believe that if this plant produces a rash it will ever be a serious or a persistent one, so it may be the safest kind of plant with which to experiment in this field. It should be obvious to you that these experiments could be tried with other plants, and out of your findings you might get a slight glimpse of the field of dermatology.

Before continuing with this work let me suggest that you get six strips of ordinary screen wire such as is used in door screens. These may well be 2 x 6 inches each, but may be larger. Bend each piece crosswise into a block U, the sides and bottoms of which will be equal, let us say 2x2 inches. Put two of these Us together to form a small wire cube the sides of which will be, let us say, 2 inches. With scrap wire stripped from your old screen trimmings wire your box together, leaving one end free to open and close as a cover. With some suitable rubber bands around the box, close it so that you may hold captive inside any experimental animals with which you may wish to work. Make three boxes.

Experimental animals

One of your three boxes will be used to hold your experimental animals such as flies, bees, wasps and other insects that you find visiting your plants with which you are experimenting. If you wish you may find a use for five boxes, but I will leave that up to you and here suggest what may be done simply with three to use as a starter.

Now the essential elements for our equipment are available. One box may be used to hold the experimental animal; the other two to hold alternative choices to which we hope our animals may react. We may assume that our animals are or are not sensitive to what they see or smell. Some time we may wish to experiment with what they taste or hear, but let us stick to seeing and smelling at the beginning.

If you notice in your garden that some bees or flies are visiting the flowers of certain plants, catch a few of the insects and put them into one of your boxes. Put some of the flowers into one of the other boxes, and let us call this box our bait box. Now try all sorts of combinations of position of the animal box, the bait box and the empty box to see if the insects in the box are attracted towards the bait. Leave them undisturbed for some time to see if their confinement affects their behavior. If you have two flowers of the same general kind but of different color, put one colored flower in one bait box and another in the other. Place these on opposite sides of the animal box to see if the animals show any preference. Place the boxes in a breezy place to learn whether the insects tend to go up wind or down wind for their favored stimulus, or if this makes no difference. If you do not have a natural breeze handy, maybe a vacuum cleaner will help you out, or an electric fan may be brought into use. Of course, you may or may not get normal results with these experiments, since some insect may react so violently to confinement that they do not respond normally to what they see or smell.

Reference to your chart section will show you that there are mem-

bers of the buttercup family whose flowers are red, white, blue, yellow and even black, or nearly black. These should be more than enough colors with which to work.

Confusing the subjects

After you have made a few observations along the lines suggested above, and if you finally come to the conclusion that you can make your insects go in some definite direction because of what they see or smell try to confuse them by putting your bait in boxes above and below the animals. Then they will have four choices of direction that they may take. Then try combinations of color, fragrance, position and wind direction and you will find that you have your hands full, but you should have gotten a taste of the fun that may be had by studying animal behavior and the time will have been well spent.

If you wish to work with taste in animals, try to locate the spots on plants where nectar may be found. Bite the spurs of columbine, of clover and of nasturtium to see how sweet they may be. Then see if you can find how insects and other animals manage to reach this hidden treasure. You may find that bees frequently take a short cut and bite their way through to the source of sweetness instead of following the route that will effect pollination. If you do not believe that the sweetness is the attraction, bite off the sweet parts of half of the flowers on a columbine plant and then observe if these flowers are visited less frequently than are those that are uninjured. This may help you form some judgment as to whether the color, the shape, or the fragrance, or the taste is the determining attraction.

I am sure that the material in the insert itself should now suggest enough other things to keep you busy so that further elaboration is unnecessary.

Giant Color Prints

Wall-sized photo-murals up to 3 by 5 feet from a 35mm. color transparency are now possible, according to Photomammoth Murals of 12,048 Vanowen Street, North Hollywood, California, producers. The firm has devised a technique for custom-making such outsized enlargements, previously thought impossible with color transparencies smaller than 4 by 5 inches.

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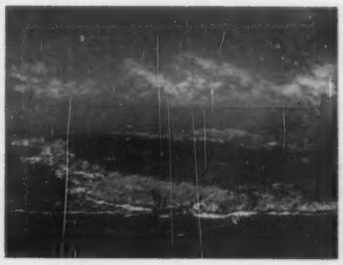
Island in Time



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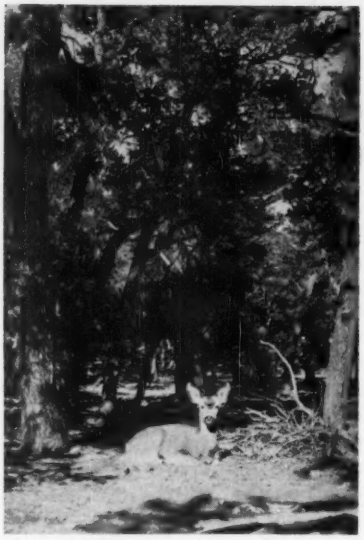
THE Nature CAMERA

By EDNA HOFFMAN EVANS



In this picture, an enlargement of a portion of the first, an attempt is made to frame the center of interest between two tree trunks. Is there too much foliage overhead?

More About Composition THIS IS A CONTINUATION OF THE discussion on composition, begun in last month's section. In the weeks that have passed since I wrote the April portion, I have paid increased attention to my own and other people's reactions to the composition of individual pictures. The results have been most intriguing.

First, let us recall the simpler definition of composition—that it is "a pleasing arrangement." Just who is to be pleased by the arrangement? Is it the person who takes the picture, or the person who views it after it has been taken? Here we begin to find ourselves going down two roads at the same time.

To be sure, there are general basic elements of good or bad composition on which we can all agree. Some pictures are unquestionably good, and some are just as unquestionably bad. But when it comes to "pleasing" one person or another—that is a different matter. We get involved in purposes and motives, and in these realms there probably can never be complete and overall agreement. So let us agree to disagree here and go on to something else.

What can be done to improve the composition of a picture after it has been taken? It is best, of course, to do as much "composing" as possible before making the exposure. But once that is done, there are still some corrections and improvements that are possible.

With color slides, the photographer is confined to a general basic size. But, with certain definite limitations, he can improve on the composition of a slide by using a variety of masks. This entails taking the transparency out of the cardboard mount (a job calling for a pen-knife) and remounting it between masks and glass plates or in a metal binder.

What should be masked? Whatever interferes with the composition of the desired picture. Some pictures fit better into a square, others are long and thin, up and down or sidewise. Some even fit best into a round frame, or occasionally, depending on the result desired, into some exotic shape. These latter, however, should be used rarely and with great care.

Using the mask

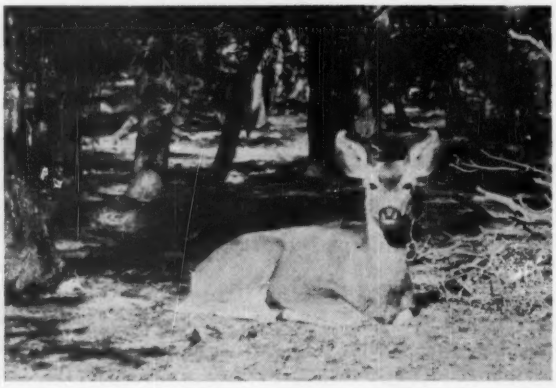
Suppose the center of interest is too far to the left or the right. Mask off the offending portion and give the picture better balance. Suppose there is some distracting element to one side, or perhaps too much foreground—those, too, can be masked. Suppose the horizon line is crooked. Use a mask slightly narrower than the original transparency and correct this by making the horizon level. Proper masking can improve—nay, it can even save—a poorly composed picture.

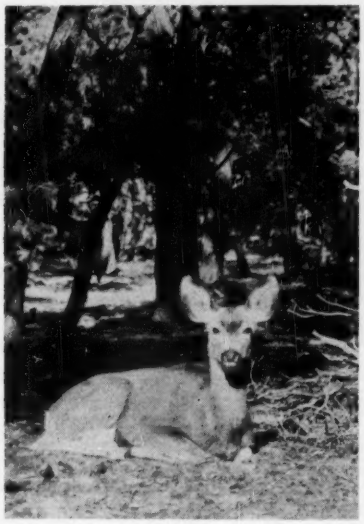
There are a number of companies that supply these handy little masks and covers. To mention a few, they include (for masks): GEMounts, 5817 Sheridan Avenue, Detroit 13, Michigan; and Crop-It, 177 Louis Street, Maywood, N. J. For the cover glasses and metal mounts try: ESCO (Erie Scientific Corporation) 693 Seneca Street, Buffalo 10, N. Y.; Eastman, or Ansco.

The black-and-white photographer can do considerably more than the color man to improve the composition of his prints. He can, that is, if he has access to an enlarger. Contact prints, alas, are difficult to

This picture represents the full negative, and there are many distracting elements in it.

A still greater enlargement in a horizontal format. Is the brush pile too distracting?





The same enlargement in a vertical format. Would cropping more at the right to eliminate the brush give better composition?

deal with, unless they are masked off in printing in much the same manner as the color transparencies.

With an enlarger in the darkroom, the photographer can really do things little short of wonderful in the way of composition improvement. The series of pictures accompanying this article will, I trust, illustrate that statement. I am not going to say specifically which one has the best composition; I have my own opinion, of course. Instead, I am going to leave the final decision up to the taste of the individual reader.

I chose this picture of a deer because I thought it had possibilities, compositionwise. It was taken several winters ago in Grand Canyon National Park with my old 4 x 5 Graflex and f4.5 lens, on Super Panchro Press film. The deer was not tame in the sense that it was someone's pet but, as a result of living in the protected park area, it was not wild enough to take flight at the first human scent. It allowed me to come within about fifty feet of it, and take the accompanying picture before it stood up and wandered off into the woods.

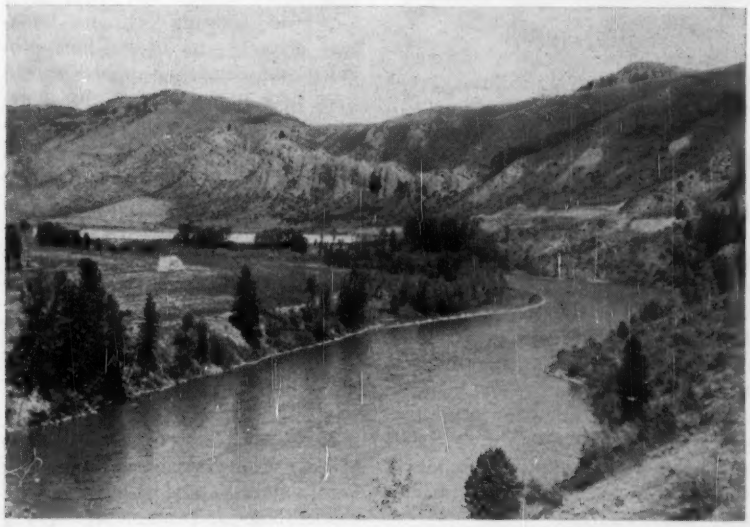
Deer is centered

The first print uses the entire negative. The deer is centered, but somewhat below the vertical center. There are many distracting elements; the sun-dappled snow patch in the foreground, the empty and meaningless areas to the right and left, the patches of light and shade. Luckily for photographic purposes, the deer had chosen to lie down in a sunny spot—it was warmer there, no doubt.

In the second picture, I have enlarged somewhat, and have cropped off the outer edges of the picture in the effort to "frame" my subject between the two tree trunks. This action brought into considerably more prominence the brush pile just behind and to the right of the deer. That brush pile, it seems to me, is more distracting here in the cropped vertical picture than it was in the original full-negative print.

Since I was trying to fit my picture into a 5 x 7 standard printing mask, I retained a great deal of the overhead foliage. I cropped the foreground, but left some of the shadows

This river scene has pleasing composition even though it lacks a definite center of interest. Note the "lead in" lines.



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and snow patch, so that my subject would not be too close to the bottom of the picture.

Some viewers may feel that there is too much meaningless foliage at the top of the picture. Possibly so. It seemed to me, however, as I tried various enlargements and placements, that the expanse of leaves above the deer gave the picture a feeling of freedom. When I cut them off, I felt that I had, somehow, penned the deer in. That, of course, is my own personal opinion.

Finally, I pushed the enlarger up almost as high as it would go, and got the resulting enlargement (the deer in the original negative is one-half inch high). The enlarging process has caused the image to become somewhat fuzzy, but please disregard the fuzziness and consider the composition.

Which is a better and more pleasing arrangement, the horizontal or the vertical? In which picture does the deer look less hemmed in? In which does the brush pile seem more intrusive? Which of all the pictures has the best composition? Which, in the final analysis, is the most artistic?

Center of interest

The deer picture has a definite center of interest. There are other objects in it, to be sure, crop as we may. But the viewer can have no doubt as to what the photographer wants him to see in the picture. Landscapes, on the other hand, may not have such definite centers of interest. Can they, too, have a pleasing arrangement? I believe so.

I think the river scene (it is the Snake River in Wyoming) has pleasing composition, even though it has no major center of interest. The river leads the eye from the lower left of the picture (as it should for Occidental eyes) and the cluster of trees in the center holds the attention for a time. But the pause is not permanent, because the white area soon leads the eye on to the left. There, the light patch reverses eye-direction and points up and back to the cliffs above. These, in turn, lead the eye back to the middle of the picture.

Nothing in the picture is exactly centered, and no area exactly matches any other either in size or in mass. The sky line is far above center and the clouds break it, but not to the extent that the trees and cliffs break the expanse of mountains below. This, too, is the full negative. Were I to crop it at all, I might cut off enough at the bottom so that the river bank would just touch the lower left corner. I would also crop a little off the left side, to eliminate the meaningless branch that intrudes itself into the picture.

Darkroom manipulation

By darkroom manipulation, the photographer can also emphasize or "hold back" certain areas in his picture. If an area is too light, he can hold back the dark places until sufficient details are "burned in." If an area is too dark, it can be "dodged" until its surroundings catch up.

The paper on which prints are made also helps overcome too great or too little contrast. These deer pictures, from a normal density negative, are printed on No. 3 paper, and as a result they are too contrasty. That was done purposely to give emphasis to the different areas. The river scene—while the negative is thinner—has been printed to give more normal contrast.

Composition is an interesting and challenging factor in photography. It is subject in which not all tastes will agree on specifies, and yet one on which most people will agree on general principles. Just remember, when dealing with the "rules" of composition, that there are exceptions to all rules, and sometimes impressive and effective results can be obtained by ignoring the rules. An experienced cook can bake a good pie by the "pinch of this and dab of that" method, and a good photographer can do likewise in composing a picture. But the beginner had better not throw the recipe book completely away, in either case.

Film Catalog

Coronet Films, of the Coronet Building, Chicago 1, Illinois, recently has released its 1958-1959 catalog of 16mm. sound motion pictures for educational use. Most of the 801 teaching films described in the 96-page, four-color catalog are available in full color as well as black-and-white, and are presented in logical sequence, from films for kindergarten and the primary grades through the intermediate grades and high school. A listing of all film titles by subject area and grade level precedes the film description to help identify at a glance the special-purpose offerings. A free copy may be secured from the Sales Department at the above address.

Largest Camp

(*Continued from page 246*)

register, he passed the crowded auditorium—and missed supper that night!

It happened that that evening's lecturing naturalist was Dr. Miller. He had rare ability to call wild birds to him. His talk on their music packed Fallen Leaf auditorium to the doors. Folks even stood at windows to hear. Seeing this popular outpouring induced Stephen Mather to ask transfer of our experiment to Yosemite National Park. This he envisioned as an effective backfire against those who sought to profiteer on this park.

Then came Mather's invitation to join his Christmas, 1919, university class reunion in Yosemite, although I was not a member of that class. He told his troubles, then said: "Take Yosemite's telegraph key. Do not return until you can report your Tahoe Laboratory will be moved here next summer." Later, Mather added: "Mrs. Goethe and you already have invested much in this. Now, as political strategy, let's give it a geographical flavor. I'll finance some; you the rest. Congress thus will sense the movement is nationwide."

The desired Congressional support eventually was consolidated by various methods. One device, (now no longer possible), was a ranger-naturalist suggestion to enthusiastic participants in the field trips: "If you feel so, why not write your two Senators and your Congressman?" Among National Parks visitors were some folks of influence. Soon came Yosemite Training School. Eventual private gifts of millions provided museums. Support spread from park to park. Additional national parks were demanded by an enlightened citizenry. It was several years, however, before Congress was convinced they were worth taxpayer's dollars. Former Interpretive Chief Yaeger later commented: "This has developed into the world's largest summer school with a 25,000,000 acre campus and an enrollment of 18,901,244." Now the "enrollment" is four times greater—as is the need!

So, here once more is a salute to Mickey Kelly, submarine gob, war hero, and "Good Citizen," via beetles, bugs, and bumblebees!

Bulletins

"Carob Culture in California," by J. Eliot Coit, is a folder outlining the culture and utilization of the carob tree and its sugary, bean-like pods that are rapidly increasing in their importance to industry and agriculture. The carob tree, noted for its great drought resistance, can be grown where minimum temperature is not lower than 20 degrees F., and where normal rainfall is not less than 12 to 14 inches annually. The folder may be obtained from Dr. Coit at 690 Ocean View Drive, Vista, California.

"Effects of Unialgal and Bacteria-Free Cultures of *Gymnodinium brevis* on Fish" is the title of the U. S. Fish and Wildlife Fisheries Bulletin 123. *G. brevis* is the minute animal that is responsible for the sporadic outbreaks of what is popularly known as "the red tide" in the Gulf of Mexico, with consequent mass mortality of marine animals. This report, by Sammy M. Ray and William B. Wilson, fishery research biologists, is an account of their studies of the effects of *G. brevis* on fish of the Gulf of Mexico, and may be obtained from the Superintendent of Documents, Washington 25, D.C., for twenty-five cents.

"Extension Bulletin 47" of Cornell University at Ithaca, New York, is a 1958 list of the many publications and bulletins on agriculture and home economics currently available from the New York State Agricultural Experiment Station at Geneva, and how such material should be ordered.

"Buying Your Sprinkler Irrigation System" is Circular 789 of the University of Illinois College of Agriculture, at Urbana, Illinois, written by Ben A. Jones, Jr., and full of facts that should be known by anyone contemplating the installation of an irrigation system for farm or other use. The booklet is free on request.

"The Forests of Free Viet Nam," recently published by Thomas W. McKinley, forestry advisor of the International Cooperation Administration in Viet Nam, is a 150-page volume that reports the results of the work that has been done to help the Vietnamese understand the important role that their forests play in the economy of that country, and the pressing need for good forestry practice. It lists also forests types in Viet Nam according to climate and geography, and the species of trees useful in lumber production. Illustrated and with maps, from the International Cooperation Administration, Washington 25, D.C.

Squid Discovered

Squid in the Maryland part of Chesapeake Bay were discovered for the first time during a bay-wide trawl survey conducted last fall by the Chesapeake Biological Laboratory and the Virginia Fisheries Laboratory, according to *Maryland Tidewater News*, publication of the staff of the Maryland Department of Research and Education. Known as the "brief squid," the species has never been recorded in Maryland waters before, although it ranges in warm waters from Delaware Bay to Florida.

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Babbitts

(*Continued from page 240*)

ill-timed collection could lead to their extinction. The children learn the life cycles of many animals, since the Babbitts believe that understanding best teaches them conservation. They are also taught never to destroy any plant or animal that is beneficial to man.

Lewis Hall Babbitt's successful scientific career takes on a deeper significance when we learn that ever since a childhood illness, he has been totally deaf. The early onset of the disease also prevented his learning to speak. But, with a firm grip on his bootstraps, he conquered these handicaps through lip reading, speech lessons, and by training his naturally quick eyes to remarkable acuity.

He is today curator of herpetology at the Worcester Natural History Society, and was for eight years staff collector for the old New England Museum of Natural History at Boston. The Babbitts are herpetology consultants for the Massachusetts Audubon Society's Conservation Workshop for adults, and for the Wildwood Camp for children in Barre, Massachusetts.

Lewis made herpetological headlines a few years ago—headlines that wrote an end to a twenty-year search for New England's only true lizard. While New England boasts ten varieties of salamanders, the distinctive blue-tailed skink is the only lizard. One lucky day, in Kent, Connecticut, Lewis collected *two* at the same time! Prior to this find, the New England Museum of Natural History had recorded no blue-tailed skinks for seventy years.

Their tight schedules notwithstanding, the busy couple still find time to share their knowledge with their fellows, and have written several articles for scientific journals.

Crab Nebula

(*Continued from page 269*)

will be full on May 3, and the New Moon will occur on May 18.

Mercury, in the morning sky, will rise in the east about an hour before the sun. It will reach its greatest western elongation on May 14, and will be most favorable for observation on that date.

Venus will rise nearly two hours before the sun all during the month of May. It will still be low in the east at sunrise. Located in Pisces, it will be the brightest object in the sky.

Mars, in Aquarius, will rise in the east at about 2:30 A.M. on May 1, 1:30 A.M. on May 31. Not yet too conspicuous, it is, however, getting gradually brighter.

Jupiter, in Virgo, will have risen by sunset. It will set just before sunrise on May 1, and at about 2:30 A.M. by the end of May. It will be very bright and will be found to the northeast of Spica.

Saturn, in Ophiuchus, due east of Antares, will rise in the southeast at about 10 P.M. on May 1, and shortly before sunset by the end of that month. It will still be low in the southwest by dawn.

A small partial eclipse of the moon will take place on May 3. Only 1.5% of the diameter of the moon will be eclipsed. In the United States, the eclipse will be visible only on the West Coast, at about 4 A.M., P.S.T.

1958 Trail Opportunities

A number of fine opportunites are presented this year to devotees of back country trail riding for spring, summer and fall. The American Forestry Association, 919 17th Street, Washington, D. C., will send on request a folder describing its 1958 expeditions into "the little kingdoms of the wilderness," with full information as to equipment, organization and costs. With the exception of trips into North Carolina's Great Smokies and a canoe trip into Minnesota's Quetico-Superior Wilderness Area, these expeditions will take you into the wild and high places of the West and Southwest.

Wampler Trail Trips, of Box 45, Berkeley 1, California, offers a variety of trips that include the High Sierras, Havasu Canyon of the Grand Canyon, and the wild Barranca country of Old Mexico; a note to Joseph Wampler, veteran archeologist-mountaineer of the above address, will bring more information.

Don Clauser, of Box 1229, Santa Fe, New Mexico, who sponsors "Don's Trail Rides in the West," has a fine program outlined for 1958, one that will take you into the Pecos country of New Mexico's high mountains, the fastnesses of the Wyoming glacier areas, and over the trails of the continental divide. He will be glad to send a folder.

Medal to Kalmbach

Half a century of distinguished service to wildlife conservation was recognized when Dr. E. R. Kalmbach became the eighth recipient of the Aldo Leopold Medal presented by the Wildlife Society. A research biologist and former director of the wildlife research laboratory of the U. S. Fish and Wildlife Service in Denver, "Doc" devoted years to work that made possible a strong factual basis for wildlife management. In addition to his noted biological contributions, Dr. Kalmbach developed the idea of postage stamps depicting American wildlife, and, as an artist, designed a number of suggested stamps. One article developing this idea was published in *Nature Magazine*. The seed thus sown resulted in the four wildlife commemorative stamps that have been issued. The medal was conferred upon the 1958 recipient of the honor by Dr. A. Starker Leopold, son of the great conservationist whose contributions the award memorializes. Earlier recipients have been J. N. Darling, Carl D. Shoemaker, Olaus J. Murie, Ira N. Gabrielson, Harold Titus, Clarence Cottam, Hoyes Lloyd and C. R. Gutermuth.

Nature Center in Danger

In April, 1956, *Nature Magazine* carried a story about the significant and in many ways unique work being carried on by the Piedmont Nature Center of the Worcester (Massachusetts) Natural History Museum. Under the direction of Leon Bascom, the activity has been making an important contribution to solving problems of deliquency by channeling youthful enthusiasms into Nature interests. Having its start in a neighborhood where juvenile behavior was a serious problem, this program changed things drastically. Originally a Junior League project, the program was taken over by the local Community Chest. The eleven years of the Center's work leaves no least doubt as to its real value and accomplishment. We now learn, however, that the modest budget of $8700 for continuation of the Center is to be dropped because it does not draw as many youngsters as a Y.M.C.A. and a Boy's Club offering swimming pools and other recreation. The announcement brought a flood of letters to the newspapers, and there is still hope of saving the Center.

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Nature AND THE MICROSCOPE

By JULIAN D. CORRINGTON

Natural Green Felt

DID YOU EVER BREAK YOUR JOURNEY BY slipping on a garden path or brick walk, covered with a slimy green felt? If you did, you were probably only getting your just deserts by having the effrontery to tread upon living plants of the genus *Vaucheria*, named for the Swiss botanist, Jean Pierre Etienne Vaucher (1763-1841). The various species inhabit fresh or brackish water, with some representatives growing on damp soil, as in greenhouses. They are members of the green algae (Chlorophyceae), and exhibit interesting types of cell growth and reproduction.

The plant consists of a long tube—microscopically speaking—the *thallus*, the central portion of which is occupied by a large vacuole. Around this space lies a thin peripheral layer of cytoplasm in which are great numbers of chloroplasts, oil droplets, and nuclei, for cell divisions are not accompanied by the formation of new cross walls, and consequently the so-called "cell" is actually a *coenocyte*—a common mass of protoplasm containing many nuclei. Note the absence of cross walls in the accompanying photomicrograph. Chloroplasts confer a green color to the tube, which may be several inches in length.

Here and there will be a few branches, some of which act as rhizoids, or root-like hold-fasts. At times the far end of any of the branches will develop a cross wall, whereon the protoplast thus separated becomes a zoospore. This develops flagella, swims away, and germinates elsewhere into a new Vaucheria plant. Thus the genus exhibits asexual reproduction; but it also shows the sexual form. Short lateral branches develop. The *antheridium* is tapering and hooked, and bears numerous biflagellate sperms, released through an aperture that forms at the tip; the *oogonium* is larger, rounded, and houses but a single egg. When mature, the oogonium elaborates a spout-like tip, through which the sperms enter. The resulting fertilized egg (zygote) rests awhile, then germinates into a new plant. In the illustration, two oogonia are shown with an antheridium between. Sometimes the reverse arrangement is noted; sometimes one of each of these reproductive organs occur side by side.

Vaucheria, 135X. In the center is an antheridium with two oogonia.

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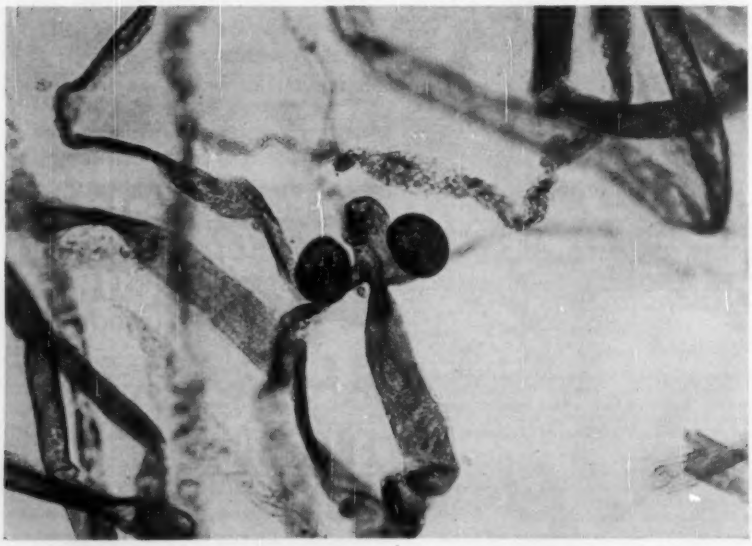

Beginner's Primer

AMONG those families in the great Order Hymenoptera that are relatively unknown to most of us, we come in this chapter to one whose members are seldom seen; yet their work is familiar to everyone. This is the Family Cynipidae, the gall-wasps, less correctly called gall-flies.

The study of plant galls and their production by insects goes back to Malpighi in the seventeenth century and to Antonio Vallisnieri, who wrote *Observations on the Fly of Rosebushes* in 1713. It must have taken a deal of astute figuring in those days to account for the presence of an insect larva within the swollen tissues of an abnormal plant growth, with no visible means of entrance. The easy way of solving the problem was to fall back upon the popular belief in spontaneous generation, but both of these men would have none of this superstition and worked solely with observable facts.

Today, although some details are still obscure, it is known that many plant galls are the result of animal activity. The culprits may be aphids (plant lice), as in witch-hazel cone-gall or cockscomb elm-gall; moths, beetles; flies, as pinecone willow-gall; the gall-wasps and gall-making mites. A former assumption, generally adopted since it seemed reasonable, was that the female arthropod, when introducing one or more of her eggs into plant tissues, included a drop or so of a fluid that "poisoned" the plant; she "stung" the plant so that the reaction was a swelling, and in this augmented tissue the egg hatched and the larva was hence surrounded by an abundance of food. However, at least in the cynipids, it is now known that the galls do not appear until the eggs hatch and the larva starts feeding, so it is premised that the stimulus, probably either a secretion or an excretion, must be produced by the larva.

Galls are of all sorts of shapes, and may have an intricate structure. This is determined by the insect rather than by the host plant, and every portion of the plant may be affected, from root to seed. Best known of all of these amazing growths are the oak apples, so called from their size and shape, one of the largest being the giant oak gall of California, made by *Andricus californicus*, attaining a diameter sometimes exceeding four inches. The gall is first green, then a whitish

brown or gray when matured and dry. The interior is pulpy and may contain from one to as many as ten or more larval chambers. As is true of all cynipid galls, the insect must cut its own exit tunnel, and there is no reproduction within the gall, such as with those caused by aphids or mites.

Adult cynipid

The adult cynipid does not exceed 6 mm. in length and is generally smaller than this. Typically it "looks down"—i.e., the small head is so overshadowed by the larger thorax that it seems to gaze downward perpetually. The antennae have 11 to 16 segments and are setiform, that is, simple and bristle-like. The forward abdominal segments extend backward on the dorsal aspect of these tiny insects so that they overlap those in the rear, resembling an inverted pile of saucepans. The wings have a greatly restricted venation, with not more than five completely closed cells. The ovipositor of females is retractile and coiled within the body; when exerted it issues from an orifice about halfway forward on the abdomen instead of from the rear terminus.

Some eighty-five percent of all cynipid galls are formed on various species of oaks, with the balance on roses or members of the compositae. Not all insects in this family are gallmakers, and in some of the closely related groups occur parasites on a wide variety of host insects, and even parasites of parasites. It is indeed a strange world that one encounters when he investigates the parasitic hymenoptera. And yet students of human sociology should feel on familiar ground; the bookmaker parasitizes the man who wants to place a bet on a horse race, the pickpocket lifts the unearned increment from the wallet of the bookmaker, and the holdup man takes it away from the pickpocket. So with the hymenoptera: the aphid sucks juices from plants, the braconid wasp lays its egg in the aphid so that the parasitic larva eats the host when it hatches, then the braconid larva is in turn parasitized by a gallwasp, and this species in turn by a chalcid fly, a form of hymenopter discussed in our next installment.

Some cynipids take advantage of the galls made by others and dwell in them (guest species), eating the plant material but doing no harm to the rightful owners (if such pirates can be referred to as "rightful"). These are classed as *inquilines*, a term taken from the Latin word for a tenant or lodger, signifying a commensal. But alas for hospitality —it is such an easy step from sharing the plant tissues to turning upon the host, and some of these guest cynipids do just that and go from cell to cell of the gall, cleaning out each host cynipid larva in turn. Is not the world of these almost microscopic creatures a wonderland of strange, familiar customs?

Microscopy Symposium

THE 1958 Microscopy Symposium, fifth in the series, will be held this year in Chicago, June 9-12, sponsored by W. C. McCrone Associates, 500 East 33rd St., Chicago 16. The place of the meetings will be the Del Prado Hotel, 53rd and Hyde Park Blvd., on the Chicago southside, just off Lakeshore Drive at 53rd Street. The atmosphere will be informal, to encourage exchanges of ideas and techniques. The programs are planned to be spontaneous; a chairman and a panel of experts will stimulate and guide discussion in each of these eight half-day sessions:

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Monday p.m. and Tuesday a.m., *Instrument tion:* Mr. Wolfgang Zieler, Zieler Instrument Co., Boston, and Dr. Oscar Richards, American Optical Co., Buffalo.

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Wednesday a.m., *Structural Materials:* Dr. L. S. Brown, Portland Cement Association Research Laboratories, Skokie, Ill.

Wednesday p.m., *X-Ray Microscopy and Autoradiography:* Dr. Albert Baez, University of Redlands, Calif.

Thursday a.m., *Electron Microscopy:* Dr. John H. L. Watson, Henry Ford Hospital, Detroit.

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For additional information contact W. C. McCrone, Jr. at the address given above.

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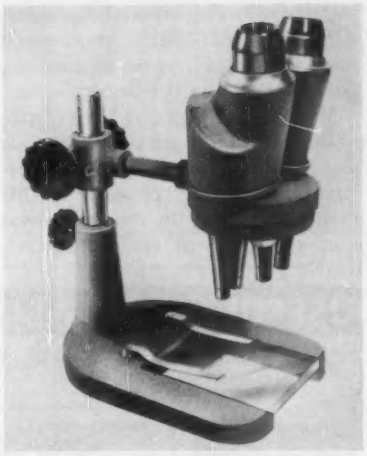

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Biocentennials

PHYSICIANS the world over have something special to celebrate in 1958, and biologists can get in on this anniversary, too, for it marks the hundredth birthday of a great book, and of one of its included aphorisms, *Omnis cellula e cellula*.

This pithy sentence, "every cell from a cell," is a cornerstone of modern biology and although not the first, it was certainly the most celebrated and widely known statement of a principle that touched off the most important laboratory research program in biology of the last half of the nineteenth century—the attack on the problems of mitosis and meiosis. The book was *Cellu-*

larpathologie, and its author Rudolf Virchow (1821-1902), pronounced *fearko* in German, *virtue* in English, both accented on the first syllable.

Virchow was born at Schivelbein, in Pomerania, the son of a small scale and unexceptional farmer and merchant. Showing promise in his earlier education, the young man was sent to Berlin to study medicine, graduating in 1843. Four years later we find him as co-founder, with Reinhardt, of a famous journal, the *Archiv für pathologische Anatomie und Physiologie*, which he carried on alone after the death of Reinhardt in 1852. For eight years during this period Virchow had to leave Berlin because of his radical political beliefs and, going to the medical school at Wurzburg, soon made such a name for himself and this institution that by 1856 he was recalled to Berlin as professor of pathological anatomy and director of the Pathological Institute.

Books and papers

Through the years one important research paper after another flowed from his tireless pen, along with many books. He led expeditions, elucidated the nature of many diseases, made important discoveries in histology, and somehow found the time and energy to become a leader in a second science field, anthropology, becoming president of the Berlin Anthropological Society and editing its journal. To all of this was added his political career, serving terms in the Reichstag, actively opposing Bismarck, becoming chairman of the finance committee and founding their budget system, waging ceaseless warfare for sanitation, pure water supply and modern sewage disposal for the German capital. All the while he was teaching classes and directing hospital work in his chief subject, pathology.

The sum total of his accomplishments is utterly amazing. No wonder that on the occasion of his eightieth birthday, in 1901, scientists from all over the world gathered in Berlin to do him honor, with addresses, medals, and presents from kings and chancellories. The next year he fell from a streetcar, fracturing his femur, an injury that led to his death some months later.

Of his numerous publications, that which is generally conceded to rank first in importance is *Cellularpathologie*. In this great milestone in the history of medicine, Virchow lays down the principle that all disease begins with the cell, and that morbid growths are the result of cell divisions. Pathology thenceforth was placed on a cellular basis, in the same manner as was happening during these years for the sciences of structure, function, and development, and was soon to eventuate for heredity. The study and practice of medicine was revolutionized, and Virchow is today regarded as the father of pathology. He stands on a lofty eminence with a very few others, as Galen, Paracelsus, and Pasteur, and his *Cellularpathologie*, translated to many tongues, is to be found today in the libraries of medical schools and hospitals, physicians and pathologists the world around.

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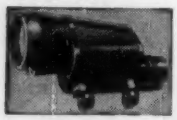

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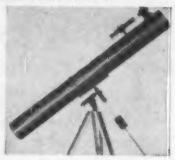

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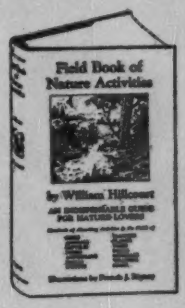

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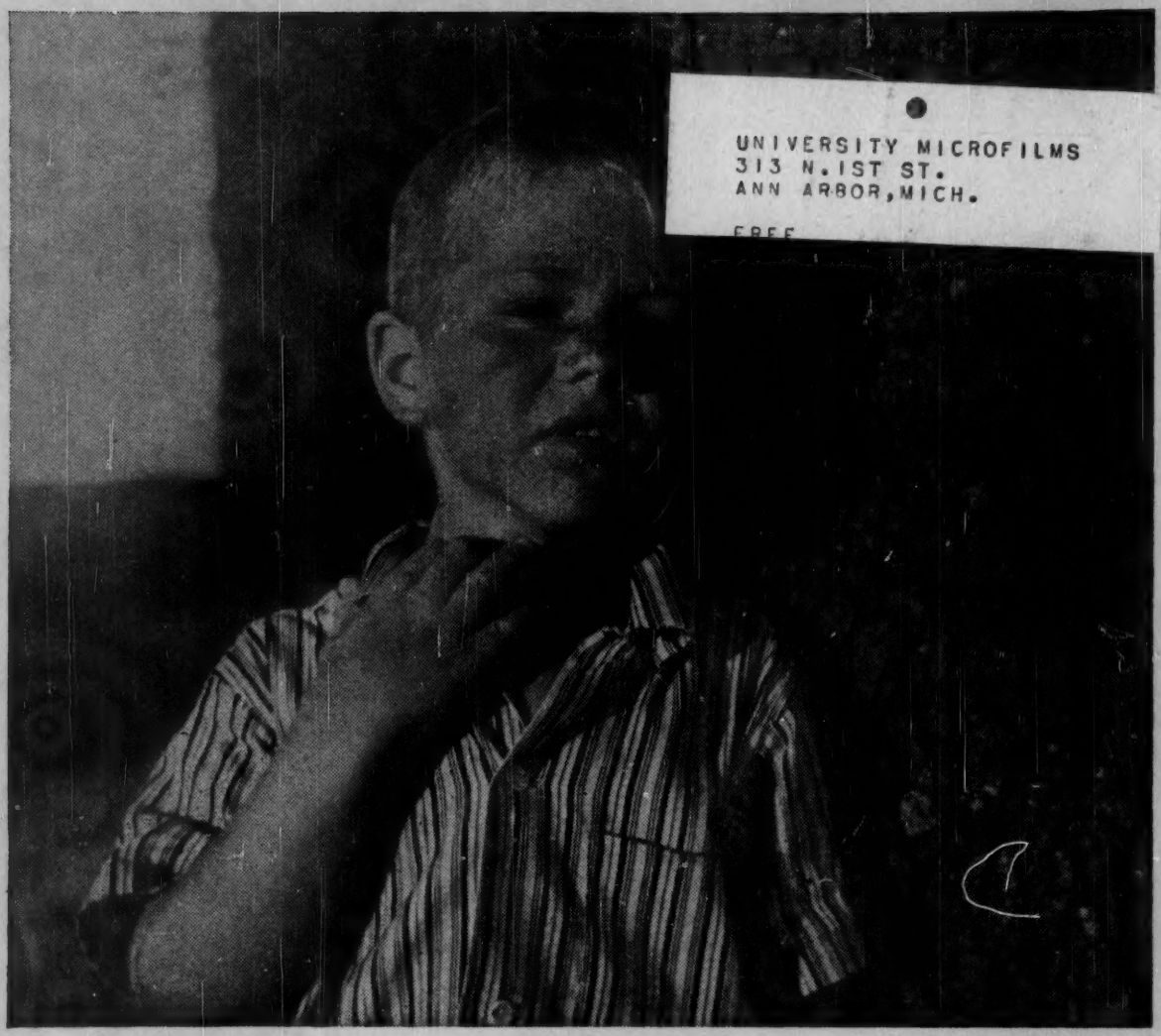

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